FOURTH FIVE-YEAR REVIEW REPORT FOR ENVIROCHEM CORP. SUPERFUND SITE BOONE COUNTY, INDIANA

Prepared by

U.S. Environmental Protection Agency
Region 5
Chicago, Illinois

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ASC	Acceptable Stream Concentrations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DCA	1,1-Dichloroethane
DNAPL	Dense Non-Aqueous Phase Liquids
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
ICs	Institutional Controls
IDEM	Indiana Department of Environmental Management
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PRGS	Permeable Reactive Gate System
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPM	Remedial Project Manager
Site	Envirochem Corp. Superfund Site
SVE	Soil Vapor Extraction
TBC	To be considereds
TBCW	Thin Barrier Curtain Wall
USACE	United States Army Corps of Engineers
UU/UE	Unlimited Use and Unrestricted Exposure

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the Fourth FYR for the Envirochem Corp. Superfund Site (Site). The triggering action for this statutory review is the completion date of the previous FYR on March 14, 2013. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of one sitewide operable unit (OU) that will be addressed in this FYR. OU1 addresses all media at the Site.

The Envirochem Corp. Superfund Site FYR was led by Matthew J. Ohl, EPA's Remedial Project Manager (RPM) for the Site. Participants included Heriberto Leon, Community Involvement Coordinator for the Site, Doug Petroff of the Indiana Department of Environmental Management (IDEM), and Mark Nichter and Robin Sternberg of the United States Army Corps of Engineers (USACE). The Potentially Responsible Party (PRP) group was notified of the initiation of the FYR. The review began on 7/6/2017.

Site Background

The Site (also known as the "Environmental Conservation and Chemical Corporation", "EnviroChem", or the "ECC" Site) is located east and south of the Boone County Resource Recovery Systems, Inc. facility on U.S. Highway 421 in a primarily rural area of Boone County, Indiana. The Site is approximately 5 miles north of Zionsville and ten miles northwest of Indianapolis. The Site, which occupies approximately 6.5 acres of land, was placed on the National Priorities List (NPL) for site cleanup in September 1983. The Northside Sanitary Landfill Superfund Site is located immediately to the east of the Site and the Third Site is located immediately to the south of the Site. The close proximity of remedial activities at both of these sites make them relevant to the Site. The remedy for the Northside Sanitary Landfill includes a cap, containment wall and groundwater collection and treatment. A non-time critical removal action is ongoing at Third Site including the following actions:

- In-situ chemical oxidation of groundwater and Dense Non-Aqueous Phase Liquids (DNAPL)
- Soil vapor extraction and excavation of soils with off-site disposal
- Sheet pile wall around the DNAPL area
- Electrical resistive heating of the DNAPL area and limited adjacent area
- Groundwater collection and treatment

An unnamed ditch, near the east side of the Site, flows into Finley Creek which flows into Eagle Creek about a half-mile downstream of the Site. Eagle Creek, in turn, feeds into the Eagle Creek Reservoir about ten miles further downstream. The Eagle Creek Reservoir has a storage capacity of 7.8 billion gallons and is one of several sources of drinking water for Indianapolis. More information on water quality is provided by Citizen's Energy Group online at http://www.citizensenergygroup.com/My-Home/Utility-Services/Water/Water-Quality.

The current land use for the surrounding area is residential, commercial, and agricultural. Nearby residents that are not connected to the municipal water supply use private wells for their water supply. Recent data indicate the potential migration of dissolved-phase contaminants, including vinyl chloride, into the sand and gravel aquifer underlying the till unit and away from source areas at the Envirochem Site toward Third Site. Further investigation, monitoring and treatment, including plume containment, are necessary. In 2017 the Site trustees began designing additional remedial action alternatives with construction planned for 2019 after EPA approves the alternative(s) and issues an Explanation of Significant Differences (ESD) or Record of Decision (ROD) amendment. The design activity is intended to better control and manage surface water and shallow groundwater at the Site and to assure that Remedial Action Objectives are met.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Envirochem Corp.		
EPA ID: IND084259951		
Region: 5	**State:** IN	**City/County:** Zionsville/Boone
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA *[If "Other Federal Agency", enter Agency name]*:		
Author name (Federal or State Project Manager): Matthew J. Ohl		
Author affiliation: U.S. EPA		
Review period: 7/6/2017 - 12/6/2017		
Date of site inspection: 10/30/2017		
Type of review: Statutory		
Review number: 4		
Triggering action date: 3/14/2013		
Due date ***(five years after triggering action date)***: 3/14/2018		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Soils at the Site are contaminated with high levels of numerous volatile and semi-volatile organic compounds, which present potential, unacceptable human health risks through exposures to soil and groundwater. The health risks are due to levels of hazardous substances exceeding EPA's risk management criteria for either the average or reasonable maximum exposure scenarios. Unacceptable risks from exposure to groundwater are attributed to the presence of various organic and inorganic hazardous substances that exist at concentrations exceeding State and Federal drinking water standards and surface water quality standards.

Response Actions

A ROD was issued by EPA on September 25, 1987, selecting a combined remedy for the Site and the adjacent Northside Sanitary Landfill Site. That ROD provided for a low-permeability cover system over the contaminated areas and a groundwater extraction and treatment system.

Based on a treatability study performed by the PRPs, EPA and IDEM, it was later determined that it would be feasible and preferable to actively treat the contaminant source at the Site, rather than simply containing these materials as provided for in the 1987 ROD. Therefore, EPA issued Amended RODs in June 1991, establishing separate, complementary remedial approaches for the Envirochem and Northside Sites.

The 1991 Amended ROD remedial action objectives include the following: preventing direct contact, inhalation, and ingestion of contaminated soils, landfill contents, groundwater, leachate, and sediment; reducing infiltration; controlling migration of contaminants to groundwater, surface water and sediments; and removing and destroying volatile organic compounds and selected base neutral/acid organics from the soils through soil vapor extraction (SVE).

As amended, the ROD for the Site required:

- Access Restrictions: Placement of deed restrictions on the property to prevent future development of the land and prohibitions on the installation of wells; thereby protecting against direct contact with contaminated soil and groundwater.

- SVE: Construction of a system utilizing injection and extraction trenches to vaporize and extract volatile organic compounds and phenols from contaminated soils. These contaminants would be captured and removed utilizing granular activated carbon. The goal of the SVE system was to clean the soil contamination source areas to levels that would assure long-term protection of groundwater and surface water.

- Resource Conservation and Recovery Act (RCRA) Compliant Cap and Surface Controls: Construction of a multi-layered cap over the entire Site. The cap would comply with RCRA performance-based standards. (The presence of the cap would also improve the efficiency of the soil vapor extraction system by reducing the amount of air and vapor that could escape from that system.) The 1987 ROD also included the removal of contaminated sediments, which is then presumed to be put under this cap. Surface controls included rerouting of the unnamed ditch west of the Site to keep surface waters further away from contaminated soil areas, and demolition and disposal of on-site buildings.

- Contingent Groundwater Treatment: Groundwater collection and treatment would be required if SVE did not achieve soil cleanup standards within a five-year operation period, or if at that time surface water or groundwater samples still showed unacceptable levels of contamination. Collected groundwater would be treated to meet effluent standards before discharge into Finley Creek. Groundwater collection and treatment would continue until cleanup standards were met.

- Monitoring of leachate, groundwater, surface water, and sediments.

The objectives of the cap are to prevent direct contact with contaminated soils, reduce infiltration, and enhance the soil vapor extraction system. The objective of the soil vapor extraction activity is to remove and destroy VOCs and selected base neutral/acid organics from the soils.

EPA and IDEM have jointly overseen cleanup activities at the Site under authority of CERCLA. EPA and IDEM entered into a Consent Decree with certain PRPs who agreed to perform the final remedy for the Site. That Consent Decree was approved by the U.S. District Court for the Southern District of

Indiana on September 10, 1991. The Consent Decree requires those PRPs to implement the remedy selected by EPA (with IDEM's concurrence) in the June 7, 1991 ROD Amendment. Subsequent Consent Decree modifications also require the PRPs to implement the modifications described in the ESDs.

Status of Implementation

The PRPs have, under EPA and IDEM supervision: (1) obtained the necessary access agreements in July 1993, with the Site owners, to permit cleanup of contaminated areas and support activities on adjacent property; (2) completed Site preparation work, including an upgrade of Site fencing, removal of Site structures and debris, decontamination and disposal of tanks, construction of pads for future decontamination and storage activities, Site grading and construction of drainage channels; (3) secured, inventoried, analyzed and removed drums of contaminated material that had accumulated on-site during previous investigations and response activities; and (4) designed and implemented the Site remedy.

During the course of the remedial design investigations, the PRPs identified nine organic compounds in Site groundwater that had not been identified at levels of concern in the Remedial Investigation (and thus did not have cleanup standards in the ROD). The parties discussed and agreed to a mechanism for establishing appropriate cleanup standards for certain of these additional compounds, and also made minor adjustments to other cleanup standards based on additional site-specific information.

The PRPs also proposed to excavate soils at the southern end of the Site when they determined that the high-water table in that area would likely hamper the effectiveness of SVE in that area. The Agencies agreed with that proposal, as reflected in the 1997 ESD. The concrete pad overlying this area was crushed and excavated with the underlying soil. The excavated soils and crushed concrete were moved to the northern area of the Site and covered along with the other material to be treated using SVE.

The remedy was also modified so that only an interim cap would be constructed prior to operating the SVE system, with a full RCRA cap to be constructed only after SVE was complete. The final cap has now been constructed, but does not extend over the excavated area at the southern end of the Site. This interim cover consisted of a minimum of 3 feet of compacted native soil, with low permeability, and 1 foot of top soil to support vegetation.

The SVE operations ceased in 2001, when it was determined that the system would not achieve cleanup standards. As a result, the Amended ROD and the Consent Decree required implementation of the contingent groundwater collection and treatment remedy. The 2006 ESD reflected a negotiated refinement to that additional work. SVE trenches were installed along the same general alignment along two sides of the capped area. The SVE trenches were used to try to capture additional mobile contaminants in the trench area. The trench system also included a Thin Barrier Curtain Wall (TBCW) and a Permeable Reactive Gate System (PRGS) to further contain and control any contaminated groundwater and surface water. Operation of the active SVE system has since been discontinued by the trustees, but the trench system continues to passively capture some shallow water, which is treated as necessary and discharged.

Due to periodically high-water volumes and questions concerning the efficiency of long-term containment, the existing remedial components are under further review, as described in more detail below. This review may lead to further refinements of the remedial action.

Since the last FYR was completed, the trustees for the PRPs have been conducting investigations at the Site to support design of additional remedial action through their contractors Ramboll Environ, and

Geosyntec. In 2013-2014 they installed piezometers and conducted test trenching to identify water collection and transmission zones. In 2015 they continued to evaluate the effectiveness of the collection system and developed the Supplemental Water Contribution Assessment Report. In 2016 they performed a comprehensive data review and updated the Site conceptual model. In 2017 they began designing additional remedial action alternatives with construction planned for 2019 after EPA evaluates and approves additional measures and issues an ESD or ROD amendment. The design is intended to better control and manage surface water and shallow groundwater at the Site and to assure that Remedial Action Objectives are met. Construction is planned to be completed in Spring of 2021.

Institutional Controls

Institutional Controls (ICs) are non-engineered instruments, such as administrative and/or legal controls that help minimize the potential for exposure to contamination and protect the integrity of the remedy. Compliance with ICs is required to assure long-term protectiveness for those areas that do not allow for UU/UE.

The remedy embodied in the ROD and Consent Decree, as amended, requires placement of deed restrictions on the property to prevent future development of the land and prohibitions on the installation of wells, containment of waste on site, and places operation and maintenance (O&M) obligations on the PRPs for the foreseeable future. As long as those obligations exist, the Site cannot be disturbed or developed. The PRPs are obliged to maintain the cap and the remedy elements under the Consent Decree, as amended.

As required by the Consent Decree, the Trustees entered an access agreement with the Bankert family, who own the Site property through a trust and live adjacent to and southwest of the Site. In addition to providing unrestricted access for Site work, the Bankerts also agree "that they will not construct or place any improvements within the Remedial Action Boundary or Support Zone Area Boundary ... unless and until the Court enters an order in USA v. Enviro-Chem determining that [the PRPs] have no further obligations...." These areas include all of the relevant portions of the Site and are identified on the ICs map included in Appendix B. The objective of the access agreement is to ensure access by EPA and IDEM, and prevent any use of the Site property and any disturbance of the cap or the remedy elements. The agreement was recorded with the Boone County Recorder's office on July 16, 1993, and states that these covenants run with the land.

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Containment area on Envirochem Property - Cap and Other Remedy Components	Yes	Yes	See Appendix B	Prohibit interference with remedy components; Prohibit use of property; Prohibit construction or placement of any improvements	Restrictive covenant in access agreement that states it runs with the land recorded at Boone County Recorder's Office on July 16, 1993
Groundwater impacted by contamination at or from the Envirochem property which exceeds cleanup standards	Yes	Yes	See Appendix B	Prohibit installation of wells; Prohibit use of groundwater	Restrictive covenant in access agreement that states it runs with the land recorded at Boone County Recorder's Office on July 16, 1993

A map showing the area to which the ICs apply is included in Appendix B.

Status of Access Restrictions and ICs: ICs in the form of a restrictive covenant within an access agreement are in place.

Current Compliance: Based on inspections and discussions with the PRP's consultants EPA is not aware of Site or media uses which are inconsistent with the stated objectives to be achieved by the ICs. No Site uses which are inconsistent with the implemented ICs or IC objectives have been noted during the Site inspection.

IC Follow-up Actions Needed: No further IC evaluation activities are needed at this time; however, EPA will further evaluate groundwater contaminant migration data to determine the need to expand ICs and will ensure any additional ICs needed are implemented. In addition, the O&M Plan will be updated to include procedures for long-term stewardship.

Long-Term Stewardship: The trustees who represent the PRPs are providing for long-term stewardship. Since compliance with ICs is necessary to assure the protectiveness of the remedy, planning for long-term stewardship is required to ensure that the ICs are maintained, monitored and enforced so that the remedy continues to function as intended. Long-term stewardship involves assuring effective procedures are in place to properly maintain and monitor the Site. Long-term stewardship will ensure effective ICs are maintained and monitored and the remedy continues to function as intended with regard to ICs. The final O&M Plan will be drafted after the remedy is constructed in 2019. It will include procedures to ensure long-term IC stewardship including regular inspections of the engineering controls and access controls at the Site, reviews of the ICs, and annual ICs reports with results of the inspection and review and certification to EPA that ICs remain in-place and are effective.

Systems Operations/Operation & Maintenance

Since the last FYR, the trustees have operated the combined SVE/groundwater collection system as a passive collection system. They are not operating the SVE and groundwater extraction systems. Only the water that enters the system through natural flow is being removed and treated.

The trustees have maintained the cover at the Site with periodic mowing and inspections for erosion and settlement. They have also repaired the perimeter fencing, and cleared excess vegetation from the inside of the fence to allow for better inspection and maintenance.

Please see the Site Inspection section of this FYR for further details on the O&M of remedy components.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR and the current status of those recommendations.

Table 2: Protectiveness Determinations/Statements from the 2013 FYR

OU #	Protectiveness Determination	Protectiveness Statement
01 (sitewide)	Will be Protective	The remedy is expected to be protective of human health and the environment upon completion of an effective remedial action and in the short term, exposure pathways that could result in unacceptable risks are being controlled. Institutional controls (ICs) are in place and effective. In order for the remedy to be protective in the long-term, additional remedial action is necessary. The Trustees who represent the PRPs for the site are planning additional investigation and evaluations to identify and design additional remedial action alternatives. These additional remedial measures may require another ESD or a ROD Amendment.

Table 3: Status of Recommendations from the 2013 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
01	Remedy failure	Complete additional investigation and evaluations; select additional remedial measures. These additional remedial measures may require another ESD or ROD Amendment. Complete construction, and operate and monitor remedy. Review ICs once final remedy elements are established.	Ongoing	The trustees developed a new site conceptual model and conducted a data gap analysis. They have been investigating site conditions to resolve data gaps and refine the conceptual model. They started designing proposed drainage systems and cover extensions in 2017 and plan to start construction in 2019 after EPA issues an ESD or ROD amendment.	NA

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available by a newspaper posting in the Zionsville Times on April 5, 2017 and the IndyStar on April 13, 2017, stating that there was a FYR and inviting the public to submit any comments to EPA. EPA did not conduct formal interviews. The results of the review and the report will be made available at the Site information repository located at Hussey-Mayfield Memorial Public Library, 250 N. Fifth Street, Zionsville, IN 46077-0840.

Data Review

Ground/surface/ASVE trench water monitoring data reports since the last FYR (Environ 2015; Ramboll Environ 2015, 2016, 2017a,b,c,d); a remedial system evaluation report (USACE 2015); an ECC Site CSM presentation (Geosyntec 2016); and a pump test (Geosyntec 2017) were reviewed for this FYR.

USACE used the GSI Mann-Kendall Toolkit for Constituent Trend Analysis (v 1.0) to statistically analyze ground, surface, and ASVE trench water concentration trends for the following:

- 1,2-Dichloroethene (total);
- Ethylbenzene;
- Methylene chloride;
- Tetrachloroethene;
- Toluene;
- 1,1,1-Trichloroethane;
- 1,1,2-Trichloroethane;
- Trichloroethene; and
- Vinyl chloride.

Trends were analyzed at each sampling location (i.e., sand/gravel groundwater monitoring wells, ASVE trench dewatering wells, PRGS manhole, and surface water; Figure 1, Appendix B) using data generated since the last FYR Report (i.e., 2013 to 2017). Data for this analysis were taken from the report titled "June 2017 Surface and Subsurface Water Sampling Enviro-Chem Superfund Site, Zionsville, Indiana" (Ramboll Environ 2017d). For instances where data from duplicate samples for a sampling location were available, the highest concentration of each analyte was used. Concentration data prior to 2015 designated as "Non-Detected" (ND) and concentration data from 2015 to 2017 qualified with a less than value (e.g., <0.50) were not included in the analysis. Data for some sampling locations/analytes were not amenable to statistical analysis due to most values being ND or qualified with a less than value. The Mann-Kendall analysis requires a minimum of four detections to establish a trend for a specific sample location. Appendix C presents output from the Mann-Kendall analysis. Exceedances of Acceptable Stream Concentrations used as acceptable levels for groundwater that may discharge to surface water and results of the Mann-Kendall trend analysis are summarized in Table 4.

Sampling locations with Acceptable Stream Concentration exceedances of surface/subsurface water concentrations from 2013 to 2017 include ASVE trench dewatering wells (Trenches 1 through 6) and the PRGS Manhole. Thus, Acceptable Stream Concentration exceedances were only observed at onsite locations, which may suggest that the remedy components (e.g., RCRA cap, TBCW, and collection trenches) are functioning as intended. However, the current monitoring approach includes no upper till unit groundwater wells and assumes the remedy components effectively limit the potential for offsite migration of contaminated groundwater present in the upper till unit at offsite locations. Sampling the

upper till unit groundwater for site-specific contaminants at downgradient locations would be a significantly beneficial addition to the monitoring approach.

Sampling locations with an "increasing" or "probably increasing" trend in surface/subsurface water concentrations from 2013 to 2017 based on Mann-Kendall analysis include sand/gravel groundwater monitoring wells S-5 ("probably increasing" for 1,2-dichloroethene and vinyl chloride) and S-6 ("probably increasing" for 1,2-dichloroethene), and ASVE trench dewatering wells for Trench 1 ("increasing" for tetrachloroethene) and Trench 6 ("increasing" for 1,2-dichloroethene, tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene and "probably increasing" for 1,1,2-trichloroethane). With the exception of Trench 1, each of these locations are located at the south (hydraulically downgradient) portion of the Envirochem Site.

The 2013 FYR raised concerns about the potential for migration of contaminated groundwater offsite. A presentation by Geosyntec consultants (Geosyntec 2016) indicated that more data is needed to evaluate whether groundwater in the upper sand and gravel unit is migrating away from the Site in a downgradient direction to the south. To address the potential for horizontal migration offsite, two approaches have been taken to confirm a horizontal hydraulic connection in the upper sand and gravel unit between onsite and offsite locations. First, contaminant concentrations in groundwater from upper sand/gravel monitoring well MW-14 (which is located offsite and downgradient) were compared to those from upper sand/gravel unit piezometer PS-3, which is located onsite immediately north of the TBCW (Geosyntec 2017). Groundwater sampling of MW-14 and PS-3 identified the same contaminants (i.e., 1,2-DCE and vinyl chloride) in both locations with concentrations in the onsite piezometer PS-3 being higher than those in the offsite downgradient well MW-14. This indicates a hydraulic connection likely exists between PS-3 and MW-14. The second approach used an aquifer pumping test that included PS-3, MW-14, and additional piezometers installed between PS-3 and MW-14 (Geosyntec 2017). Results of the aquifer pumping test confirmed that a hydraulic connection is present in the upper sand and gravel unit between the Envirochem Site and MW-14. Based on this empirical evidence for hydraulic connectivity between the Envirochem Site and the offsite location MW-14, and the "probably increasing" trends of contaminants noted in some of the hydraulically downgradient sand/gravel groundwater monitoring wells (i.e., S-5 and S-6), there is the potential for migration of contaminated groundwater offsite. This raises concerns about exposure of offsite residents via drinking water (i.e., private wells) and/or vapor intrusion, and the need to evaluate whether ICs should be extended south of the property to prohibit groundwater use hydraulically downgradient of Site.

Some issues also exist with regard to understanding groundwater contaminant concentrations and potential vertical groundwater migration in the central area of the Envirochem Site. No piezometers or monitoring wells in the central area of the Site, i.e., the area of the engineered RCRA cap and the former southern concrete pad, have been sampled in the monitoring program to collect groundwater contaminant concentration data or groundwater elevation data since the construction of the TBCW. The absence of such data for the central area of the Envirochem Site limits the ability to understand horizontal and vertical groundwater flow behavior, and to determine if there are vertical hydraulic gradients that potentially affect contaminant migration between the upper till unit and the upper sand and gravel unit. There are piezometers located near the TBCW and collection trenches, but it is unlikely that data from these locations along the perimeter of the Site are representative of vertical gradients or contaminant concentrations present in the central area of the Site. As such, the distribution of groundwater contaminant concentrations in the upper till unit and upper sand and gravel unit present beneath the entire Site is unknown, and any associated groundwater contaminant concentration trends cannot be evaluated without further data.

Table 4. Exceedances of Acceptable Stream Concentrations (ASC) and Results Of Mann-Kendall Statistical Analysis of the Concentration Trends for Each Sampling Location at Envirochem Site, Zionsville, Boone County, Indiana (June 2013 – June 2017)*

Sampling Location and Description		Contaminant								
		1,2-DCE (total)	Ethyl-benzene	Methylene Chloride	Tetra-chloroethene	Toluene	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride
Sand/Gravel Groundwater Monitoring Wells										
S-1 onsite; upgradient	Trend	NA-1	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	NA-1
	Number of sampling events exceeding ASC	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
S-4B onsite	Trend	NA-2	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	No trend
	Number of sampling events exceeding ASC	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
S-5 onsite; downgradient	Trend	**Probably increasing**	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	**Probably increasing**
	Number of sampling events exceeding ASC	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
S-6 offsite; downgradient	Trend	**Probably increasing**	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	No trend
	Number of sampling events exceeding ASC	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
MW-14 offsite; downgradient	Trend	Stable	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	Decreasing
	Number of sampling events exceeding ASC	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
ASVE Trench Dewatering Wells and PRGS Manhole										
Trench 1 onsite; along eastern fence line	Trend	Decreasing	NA-2	Decreasing	**Increasing**	Decreasing	Decreasing	Probably decreasing	No trend	Decreasing
	Number of sampling events exceeding ASC	**12 of 12**	0 of 12	**2 of 12**	**8 of 12**	0 of 12	0 of 12	0 of 12	0 of 12	**8 of 12**
Trench 2 onsite; along eastern fence line	Trend	Stable	Stable	No trend	Stable	No trend	Stable	Stable	No trend	Stable
	Number of sampling events exceeding ASC	**12 of 12**	0 of 12	**3 of 12**	**4 of 12**	0 of 12	0 of 12	0 of 12	0 of 12	**3 of 12**
Trench 3	Trend	Stable	Stable	No trend	Stable	No trend	Stable	Decreasing	Stable	No trend
	Number of sampling events exceeding ASC	**11 of 12**	0 of 12	**2 of 12**	**2 of 12**	0 of 12	0 of 12	**1 of 12**	0 of 12	0 of 12
Trench 4	Trend	Stable	NA-2	No trend	Probably decreasing	Stable	Stable	Decreasing	Stable	No trend

Sampling Location and Description		Contaminant								
		1,2-DCE (total)	**Ethyl-benzene**	**Methylene Chloride**	**Tetra-chloroethene**	**Toluene**	**1,1,1-TCA**	**1,1,2-TCA**	**TCE**	**Vinyl Chloride**
onsite; along eastern fence line	Number of sampling events exceeding ASC	**9 of 11**	0 of 11	**1 of 11**	**1 of 11**	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
Trench 5 onsite; along eastern fence line	Trend	Stable	NA-2	Probably decreasing	Decreasing	No trend	Probably decreasing	Decreasing	Stable	No trend
	Number of sampling events exceeding ASC	**10 of 12**	0 of 12	**1 of 12**	**2 of 12**	0 of 12	0 of 12	0 of 12	0 of 12	0 of 12
Trench 6 onsite; along southern fence line	Trend	**Increasing**	NA-2	No trend	**Increasing**	No trend	**Increasing**	**Probably increasing**	**Increasing**	Stable
	Number of sampling events exceeding ASC	**12 of 12**	0 of 12	**2 of 12**	**4 of 12**	0 of 12	0 of 12	0 of 12	**10 of 12**	0 of 12
Trench 7 onsite; along southern fence line	Trend	Stable	NA-1	NA-2	NA-1	NA-2	Probably decreasing	NA-1	NA-1	Stable
	Number of sampling events exceeding ASC	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11	0 of 11
PRGS Manhole onsite; north of Trench 6	Trend	Decreasing	NA-1	Decreasing	Stable	No trend	Stable	Decreasing	Stable	Probably decreasing
	Number of sampling events exceeding ASC	**10 of 10**	0 of 10	**1 of 10**	0 of 10	0 of 10	0 of 10	0 of 10	**9 of 10**	0 of 10
Surface Water										
SW-1 offsite; eastern side gradient	Trend	NA-2	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	NA-1
	Number of sampling events exceeding ASC	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9
SW-2 offsite; eastern side gradient	Trend	NA-2	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	NA-1
	Number of sampling events exceeding ASC	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9
NSL-1 offsite; eastern side gradient	Trend	Stable	NA-1	NA-2	NA-1	NA-2	NA-1	NA-1	NA-1	NA-1
	Number of sampling events exceeding ASC	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9	0 of 9

NA-1 = Data were not amenable to statistical analysis because data prior to 2015 were designated as "Non-Detected" (ND) and data from 2015 to 2017 were qualified with a less than value (e.g., <0.50).

NA-2 = Data were not amenable to statistical analysis because data values previous to 2015 that were qualified as estimated (J qualifier) were less than data values from 2015 to 2017 that were qualified with a less than value (e.g., <0.50).

* "A statistical result of "No Trend" indicates that the concentration cannot be determined to be either increasing or decreasing over time with sufficient statistical confidence. This outcome differs from "Stable," which also indicates neither an increasing nor a decreasing trend, but with less variability in concentrations from one sampling episode to the next" (GSI Environmental Inc., 2012).

Site Inspection

The inspection of the Site was conducted on 10/30/2017. In attendance were Matthew Ohl of EPA, Doug Petroff of IDEM, Mark Nichter of USACE, Robin Sternberg of USACE, and Andrew Gremos of Ramboll Environ, contractor for the Trustees that represent the PRPs. The purpose of the inspection was to assess the protectiveness of the remedy.

During the Site inspection, attendees walked the Site and visually inspected and photographed monitoring wells, vegetative cover, drainage ditches, access roads, security fencing, above-ground utilities, the treatment building, tanks, and ancillary piping, paying particular attention to whether site maintenance issues noted in the 2013 FYR Report had been addressed. Photographs from the Site inspection can be found in Appendix D. In addition, EPA and USACE informally interviewed Greg Scarpone, an employee of the subcontractor IWM Consulting Group LLC, regarding O&M of the groundwater treatment system.

EPA/USACE noted:

- the stick-up monitoring wells were secured with locks, and the flush-mount monitoring wells were secured with bolt-down well covers (Photographs 4 – 13; Appendix D);
- vegetation along the interior side of the security fencing was generally absent, but vegetation present along the exterior side of the fencing may still affect the integrity of this access control (Photographs 29, 30; Appendix D);
- there was a perimeter warning sign only at the Site entrance;
- vegetative growth was accumulating in drainage ditches and culverts suggesting the frequency of vegetation clearing may be inadequate (Photographs 23, 24, 26 – 28; Appendix D);
- cat tail rushes were growing on the decontamination pad;
- there were no signs of standing water, subsidence, or erosion on the cap;
- remnants of woody growth were evident on the cap suggesting that the frequency of mowing may be inadequate;
- the building and groundwater treatment system equipment appeared to be in good working order with only minor maintenance issues (i.e., minimal water leakage to the concrete floor adjacent to the carbon filtration tanks; Photograph 17; Appendix D);
- pre-treatment, post-treatment, and other groundwater treatment sample tap locations for systems operation and NPDES discharge permit were not explicitly labeled (Photographs 15, 16, 18, 19; Appendix D);
- no groundwater treatment system log of operations was maintained on site; and
- the groundwater treatment system O&M manual was available but appeared to be outdated (i.e., 1999) (Photograph 20; Appendix D).

O&M issues with the groundwater treatment system are described in monthly reports. According to the employee of IWM Consulting Group LLC, cleaning of the air stripper and change-out of the carbon filtration tanks is based on professional judgment (e.g., increases in system pressure).

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

No. Since the last FYR was completed, the augmented SVE treatment system required by the 2006 ESD has failed to meet cleanup standards. The low permeability cover appears to be in good condition; however, it can't prevent the release of hazardous substances in contact with the groundwater. Other components, including the TBCW and the trench system, were designed primarily to collect the necessary amount of water from the upper till unit to enable potential successful SVE treatment. The design of the PRGS, TBCW and trench system may not be adequate to treat and contain the groundwater given the failure of the SVE system to meet clean-up standards. Additional remedial action is being planned. As these plans are completed, EPA will determine whether an ESD or ROD Amendment will be necessary. Given that the current SVE treatment system is not operating and additional remedial action is being planned, O&M costs and optimization opportunities to improve the performance and/or reduce costs will be evaluated in the next FYR. The failure of the remedial action could place protectiveness at risk in the future.

Access controls are in place to prevent exposure (*e.g.*, fencing). Effective ICs are also in place for the Site property to prevent exposure to contaminated materials and groundwater, and to prevent interference with the remedy. The property is currently zoned for commercial/industrial use. Based on inspections and monitoring, there appears to be compliance with the objectives of the required land and groundwater use restrictions. However, based on empirical evidence for hydraulic connectivity between the Envirochem Site and the offsite location MW-14, there is the potential for migration of contaminated groundwater offsite. An evaluation of whether ICs should be extended south of the property to prohibit groundwater use hydraulically downgradient of Site is also warranted. Should it be found that contaminated groundwater is migrating offsite and ICs are needed, EPA will ensure additional ICs are implemented.

Since the last FYR was completed, the trustees for the PRPs have been conducting investigations at the Site to support design of additional remedial action. In 2013 - 2014 they installed piezometers and conducted test trenching to identify water collection and transmission zones. In 2015 they continued to evaluate the effectiveness of the collection system and developed the Supplemental Water Contribution Assessment Report. In 2016 they performed a comprehensive data review and updated the Site conceptual model. In 2017 they began designing additional remedial action alternatives with construction planned for 2019 after EPA issues an ESD or ROD amendment. The design is intended to better control and manage surface water and shallow groundwater at the Site and to assure that Remedial Action Objectives are met.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary:

No.

Changes in Standards and TBCs: As discussed in the last FYR, the Amended ROD, which the Trustees have agreed to implement under the Consent Decree, confirms that "As remedial action progresses, these benchmark levels must be reviewed because the underlying standards and criteria change over time as scientific knowledge increases." The Acceptable Stream Concentrations used as acceptable levels for groundwater that may discharge to surface water are found in Attachment Z-1 to the Consent Decree and in the remedial design. Since the last FYR was completed, EPA and IDEM have not reviewed the Acceptable Stream Concentrations for the Site because the trustees are designing new remedial activities for the Site; however, if any remedial action activities would allow for the potential discharge of contaminants that exceed these levels, the Trustees would need to agree to adopt the more protective levels as required by the ROD.

Federal Applicable or Relevant and Appropriate Requirements (ARARs) of the ROD consist of the Clean Water Act, the Clean Air Act, National Ambient Air Quality Standards, and OSHA and DOT standards. State ARARs include the groundwater standards and other appropriate sections of Part 201 and Part 31 of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended. With the exception of arsenic, neither Federal MCLs nor State groundwater standards have changed significantly since the time of the ROD, as amended. With the exception of the Acceptable Stream Concentrations issue discussed above, federal and state standards for surface water quality and protection of aquatic life have not changed since the time of the ROD, as amended. There are no known newly promulgated standards applicable to the site. There is no known use of TBCs to establish cleanup levels at the site.

Changes in Toxicity and Other Contaminant Characteristics: Toxicity and other factors for some contaminants of concern have not changed significantly except for 1,1-dichloroethane (DCA). EPA and IDEM agreed to add a minor change in the cleanup standard for 1,1 -dichloroethane ("DCA"). The change in the DCA cleanup standard was based on information about the cancer potency of DCA developed since the time of the 1991 ROD Amendment. Since that time, a general scientific consensus has developed that concludes DCA does not pose the level of cancer risk previously believed. For more information see the Agency for Toxic Substances and Disease Registry's toxicological profile for DCA available online at the following website: http://www.atsdr.cdc.gov/toxprofiles/tpl33.html

As a result, the risk calculation and cleanup standard for DCA were re-calculated to reflect this information. For more information, see the Agency for Toxic Substances and Disease Registry's toxicological profile for DCA available online at http://www.atsdr.cdc.gov/toxprofiles/tp133.html. Toxicity factors for contaminants of concern at the Site have not changed in a way that could affect the protectiveness of the remedy. Other contaminant characteristics have not changed in a way that could affect the protectiveness of the remedy.

Unanticipated and Emerging Contaminants: Unanticipated toxic byproducts of the remedy, not previously addressed by the decision documents, have not been identified. However, the presence of the emerging contaminant 1,4-dioxane has been detected in the ASVE Trench 6 dewatering well (36 and 44

µg/L in December 2016 and June 2017, respectively); sand/gravel groundwater monitoring wells MW-14 (44.8 µg/L in June 2017), S-4B (1.37 µg/L in June 2017), and S-5 (16.1 µg/L in June 2017); and surface water location NSL-1 (48 µg/L in June 2017) (Tech Law 2017; Ramboll Environ 2017c). There is currently no federal MCL for 1,4-dioxane in drinking water. However, EPA considers 1,4-dioxane to be a likely carcinogen to humans by all routes of exposure and has established a screening level of 0.67 µg/L for 1,4-dioxane in tap water. Furthermore, several states including California, Colorado, Massachusetts, and New Hampshire have established ≤ 1 µg/L standards for 1,4-dioxane in groundwater.

Changes in Risk Assessment Methods: Changes in risk assessment methodologies since the time of the ROD do not significantly impact the protectiveness of the remedy.

Changes in Exposure Pathways: Land use or expected land use on or near the site has not changed. Physical site conditions or the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy. However, based on empirical evidence for hydraulic connectivity between the Envirochem Site and the offsite location MW-14, there is the potential for migration of contaminated groundwater offsite which raises concerns about exposure of offsite residents via drinking water (i.e., private wells) and vapor intrusion.

As noted in the 2013 FYR, nearby residences that are not connected to the municipal water supply use private wells for their drinking water supply. A Health Consultation prepared by the Indiana State Department of Health in 2002 for the adjacent Third Site (https://web.archive.org/web/20161217171201/https://www.atsdr.cdc.gov/HAC/pha/pha.asp?docid=890&pg=1#back) concluded that private well water within one mile of Third Site poses no public health hazard and that the confining layer should protect area wells from becoming contaminated with contaminants that are present in shallow groundwater on Third Site. Given that the most recent formal evaluation of monitoring data for private wells in the vicinity of the Site was 16 years ago, follow-up sampling of these wells is warranted.

The 2013 FYR stated that the EPA expected the Trustees to evaluate the potential for vapor intrusion issues by 2014. To date, such an evaluation of the potential for vapor intrusion to be an exposure pathway of concern has not taken place and is included as an ongoing issue and recommendation in this FYR.

Expected Progress Towards Meeting RAOs: The remedy is not expected to progress toward meeting the final RAOs until the operation of an effective remedial action.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
none

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 01	Issue Category: Remedy Performance			
	Issue: Remedy failure.			
	Recommendation: Complete design, selection, and construction of additional remedial measures.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Unknown	Yes	PRP	EPA/State	10/14/2022

OU(s): 01	Issue Category: Institutional Controls			
	Issue: Additional ICs may be needed.			
	Recommendation: Evaluate the need for ICs to cover the extent of the contaminated groundwater plume offsite and implement if needed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Unknown	Yes	PRP	EPA/State	10/14/2022

OU(s): 01	Issue Category: Monitoring			
	Issue: Potential vapor intrusion pathway.			
	Recommendation: Conduct vapor intrusion investigation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Unknown	Yes	PRP	EPA/State	4/1/2019

OU(s): 01	Issue Category: Monitoring			
	Issue: Contaminated groundwater plume is not under control and may be migrating offsite.			
	Recommendation: Expand monitoring network and conduct groundwater monitoring to determine extent of groundwater plume and its quality.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Unknown	Yes	PRP	EPA/State	4/1/2019

OU(s): 01	Issue Category: Monitoring			
	Issue: New contaminant of concern found, 1,4-dioxane.			
	Recommendation: Update groundwater monitoring plan to include 1,4-dioxane and implement.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Unknown	Yes	PRP	EPA/State	12/14/2018

OU(s): 01	Issue Category: Monitoring			
	Issue: Residential wells in the vicinity of the Site may be impacted by the migration of the contaminated groundwater plume.			
	Recommendation: Add residential wells monitoring to groundwater monitoring plan and sample residential wells.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Unknown	Yes	PRP	EPA/State	12/14/2018

OU(s): 01	Issue Category: Institutional Controls			
	Issue: Lack of long-term stewardship of ICs.			
	Recommendation: Update O&M Plan to include long-term stewardship procedures for ICs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	10/14/2022

OTHER FINDINGS

In addition, the following are recommendations that were identified during the FYR. These recommendations may improve management of O&M, but do not affect current nor future protectiveness:

- A comprehensive evaluation of monitoring objectives and the means to satisfy them should be completed, followed by a document that establishes the program and provides a means for modifying the program as conditions change over time. The plan should provide clear justification for what locations/depths require sampling and water level monitoring and how that data will meet the program's objectives. EPA's data quality objectives ("DQOs") system (reference EPA/240/B-06/001) provides the appropriate framework for implementing this recommendation. The plan should consider the installation of additional monitoring wells in both the till and sand units. Current coverage is inadequate, particularly in the till unit, the central area of the Site, and along the west boundary.

- The on-site O&M Manual for the wastewater remediation system is dated 1999, and the O&M Manual for the air stripper is dated 2011. Current O&M manuals, process flow diagrams, and process and instrumentation diagrams have not been developed. The treatment system has undergone several modifications, additions, and reconfigurations since its initial construction. Maintaining up-to-date documentation and plans for treatment systems is a best-practice and should be performed. Treatment system logs should also be maintained on site.

- Components of the on-site groundwater treatment system are not properly labeled. Labeling is warranted to identify the components and the tap locations for systems operations. Also, the NPDES discharge permit is not properly labeled.

- A cap inspection and performance monitoring program should be established to ensure the cap maintains its function over time. An accompanying monitoring plan should be developed to describe the procedures used to maintain and inspect the cap and remedy for any deficiencies that develop.

- Only one perimeter warning sign was observed at the subject property entrance. No other warning signs were present. Additional warning signs should be posted along the length of the perimeter fence. Warning signs should prohibit entry to the property, the installation of wells, and the use of groundwater.

- Vegetative growth is present along the exterior of the perimeter fence. The integrity of this access control may be impacted by the vegetative growth. In addition, vegetative growth is present in the perimeter drainage ditch and associated culverts. The vegetative growth might impact storm water control and/or allow surface water infiltration points. Additional vegetative control should be conducted.

VII. PROTECTIVENESS STATEMENT

OU1 & Sitewide Protectiveness Statement	
Protectiveness Determination: Protectiveness Deferred	*Planned Addendum Completion Date:* 10/14/2022

Protectiveness Statement:

A protectiveness determination of the remedy at the Envirochem Corp. Superfund site cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions:

- Conduct vapor intrusion investigation;
- Expand monitoring network and conduct groundwater monitoring to determine extent of groundwater plume and its quality;
- Evaluate the need for ICs to cover the extent of the contaminated groundwater plume offsite and implement if needed;
- Update groundwater monitoring plan to include 1,4-dioxane and implement; and
- Add residential wells monitoring to groundwater monitoring plan and sample residential wells.

It is expected that these actions will take approximately 4.5 years to complete at, which time a protectiveness determination will be made.

VIII. NEXT REVIEW

The next FYR report for the Envirochem Corp. Superfund Site is required no less than five years from EPA's signature date of this review.

APPENDIX A – REFERENCE LIST

Environ 2015. December 2014 Surface and Subsurface Water Sampling Event Enviro-Chem Superfund Site, Zionsville, Indiana, EPA ID: IND084259951. March 27.

Geosyntec Consultants (Geosyntec) 2017. Enviro-Chem Superfund Site Pumping Test EPA ID: IND084259951. December 7.

Geosyntec 2016. ECC Site CSM. April 22.

GSI Environmental Inc. 2012. Software User's Manual. GSI Mann-Kendall Toolkit. For Constituent Trend Analysis. Version 1.

Ramboll Environ 2015. June 2015 Surface and Subsurface Water Sampling Event Enviro-Chem Superfund Site, Zionsville, Indiana, EPA ID: IND084259951. 25 August.

Ramboll Environ 2016. December 2015 Surface and Subsurface Water Sampling Event Enviro-Chem Superfund Site, Zionsville, Indiana, EPA ID: IND084259951. 31 August.

Ramboll Environ 2017a. June 2016 Surface and Subsurface Water Sampling, Revision 1, Enviro-Chem Superfund Site, Zionsville, Indiana, EPA ID: IND084259951. 15 February.

Ramboll Environ 2017b. December 2016 Surface and Subsurface Water Sampling Enviro-Chem Superfund Site, Zionsville, Indiana, EPA ID: IND084259951. 28 June.

Ramboll Environ 2017c. 1,4-Dioxane Water Sampling Results, Enviro-Chem (ECC) Superfund Site, Zionsville, Indiana. 21 July.

Ramboll Environ 2017d. June 2017 Surface and Subsurface Water Sampling Enviro-Chem Superfund Site, Zionsville, Indiana, EPA ID: IND084259951. 31 October.

Ramboll Environ 2017e. CAP Extensions with Drainage Improvements, Design and Preliminary Construction Plan Report Revision 1, Enviro-Chem Superfund Site, 985 S. US Highway 421, Zionsville, Indiana. December.

USACE 2015. Remedial System Evaluation. Enviro-Chem Superfund Site, Zionsville, Indiana. 17 July.

Tech Law 2017. Data Set E170605: GCMS 1,4-Dioxane samples for Envirochem using Method 522 (CRL Method MS035 ver 1.0, effective March 30, 2017). 26 June.

APPENDIX B – MAPS

SITE PLAN SHOWING ACCESS CONTROLS

ENVIRO-CHEM SUPERFUND SITE
985 S. US HIGHWAY 421
ZIONSVILLE, INDIANA

APPENDIX

B

APPENDIX B: SITE PLAN SHOWING INSTITUTIONAL CONTROLS

ENVIRO-CHEM SUPERFUND SITE
985 S. US HIGHWAY 421
ZIONSVILLE, INDIANA

Source: ESRI, USACE Louisville District, EPA Map: JAH; Date: 20180205

Legend

- Support Zone - No construction or improvements allowed.
- Remedial Area - No construction or improvements allowed.
- Parking Area - Ingress, egress, and access to Remedial and Support Areas allowed.

APPENDIX C – MANN-KENDALL STATISTICAL ANALYSIS OUTPUT

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	SW1a
Facility Name:	USACE	Constituent:	Sampling location SW-1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION SW-1 CONCENTRATION (µg/L)						
1	17-Jun-13	0.097 J	ND	0.36 JB	ND	0.056 J		
2	18-Dec-13	0.090 J	ND	0.11 UB	ND	0.048 J		
3	24-Jun-14	ND	ND UJ	0.087 U	ND UJ	0.058 U		
4	15-Dec-14	ND	ND	0.024 J	ND	ND		
5	10-Jun-15	<0.50	<0.50	<0.50	<0.50	<0.50*		
6	8-Dec-15	0.094 J	<0.50	<0.50*	<0.50	<0.50*		
7	6-Jun-16	<0.50	<0.50	<0.50	<0.50	<0.50		
8	5-Dec-16	<0.50	<0.50	<0.50	<0.50	<0.50		
9	12-Jun-17	<0.50	<0.50	<0.50	<0.50	<0.50		
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	SW1b
Facility Name:	USACE	Constituent:	Sampling location SW-1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION SW-1 CONCENTRATION (µg/L)						
1	17-Jun-13	ND	ND	ND	ND			
2	18-Dec-13	ND	ND	ND	ND			
3	24-Jun-14	ND	ND	ND	ND UJ			
4	15-Dec-14	ND	ND	ND	ND			
5	10-Jun-15	<0.50	<0.50	<0.50	<0.50			
6	8-Dec-15	<0.50	<0.50	<0.50	<0.50			
7	6-Jun-16	<0.50	<0.50	<0.50	<0.50			
8	5-Dec-16	<0.50	<0.50	<0.50	<0.50			
9	12-Jun-17	<0.50	<0.50	<0.50	<0.50			
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	SW2a
Facility Name:	USACE	Constituent:	Sampling location SW-2
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION SW-2 CONCENTRATION (µg/L)						
1	17-Jun-13	0.099 J	ND	0.28 JB	ND	0.042 J		
2	18-Dec-13	0.063 J	ND	0.069 UB	ND	0.051 J		
3	24-Jun-14	0.061 J	ND UJ	0.099 U	ND UJ	0.060 U		
4	15-Dec-14	0.065 J	ND	0.033 J	ND	ND		
5	10-Jun-15	<0.50	<0.50	<0.50	<0.50	<0.50		
6	8-Dec-15	<0.50	<0.50	<0.50*	<0.50	<0.50*		
7	6-Jun-16	<0.50	<0.50	<0.50	<0.50	0.33 J		
8	5-Dec-16	<0.50	<0.50	<0.50	<0.50	<0.50		
9	12-Jun-17	<0.50	<0.50	<0.50	<0.50	<0.50		
10								
11								
12								
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14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	SW2b
Facility Name:	USACE	Constituent:	Sampling location SW-2
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION SW-2 CONCENTRATION (µg/L)						
1	17-Jun-13	ND	ND	ND	ND			
2	18-Dec-13	ND	ND	ND	ND			
3	24-Jun-14	ND	ND	ND	ND UJ			
4	15-Dec-14	ND	ND	ND	ND			
5	10-Jun-15	<0.50	<0.50	<0.50	<0.50			
6	8-Dec-15	<0.50	<0.50	<0.50	<0.50			
7	6-Jun-16	<0.50	<0.50	<0.50	<0.50			
8	5-Dec-16	<0.50	<0.50	<0.50	<0.50			
9	12-Jun-17	<0.50	<0.50	<0.50	<0.50			
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	NSL1a
Facility Name:	USACE	Constituent:	Sample location NSL-1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLE LOCATION NSL-1 CONCENTRATION (µg/L)						
1	17-Jun-13	0.099	ND	0.27 JB	ND	0.047 J		
2	18-Dec-13	0.18	ND	0.14 UB	ND	0.042 J		
3	24-Jun-14	0.1	ND UJ	0.071 U	ND UJ	0.049 U		
4	15-Dec-14	0.071	ND	0.024 J	ND	ND		
5	10-Jun-15	0.067	<0.50	<0.50	<0.50	<0.50*		
6	8-Dec-15	0.1	<0.50	<0.50*	<0.50	<0.50*		
7	6-Jun-16	<0.50	<0.50	<0.50	<0.50	<0.50		
8	5-Dec-16	<0.50	<0.50	<0.50	<0.50	<0.50		
9	12-Jun-17	<0.50	<0.50	<0.50	<0.50	<0.50		
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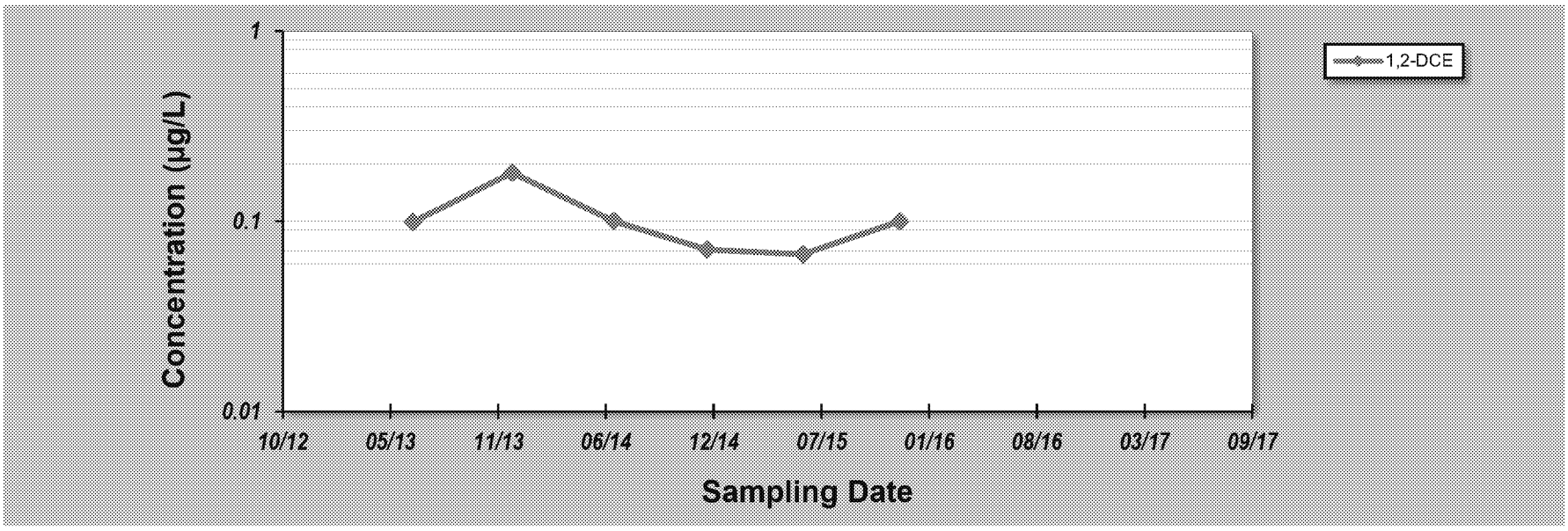
Coefficient of Variation:		0.40						
Mann-Kendall Statistic (S):		-4						
Confidence Factor:		70.3%						
Concentration Trend:		Stable						



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	NSL1b
Facility Name:	USACE	Constituent:	Sampling location NSL-1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION NSL-1 CONCENTRATION (µg/L)						
1	17-Jun-13	ND	ND	ND	ND			
2	18-Dec-13	ND	ND	ND	ND			
3	24-Jun-14	ND	ND	ND	ND UJ			
4	15-Dec-14	ND	ND	ND	ND			
5	10-Jun-15	<0.50	<0.50	<0.50	<0.50			
6	8-Dec-15	<0.50	<0.50	<0.50	<0.50			
7	6-Jun-16	<0.50	<0.50	<0.50	<0.50			
8	5-Dec-16	<0.50	<0.50	<0.50	<0.50			
9	12-Jun-17	<0.50	<0.50	<0.50	<0.50			
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Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	PRGS1a
Facility Name:	USACE	Constituent:	Sampling location PRGS Manhole
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION PRGS MANHOLE CONCENTRATION (µg/L)						
1	31-Jul-13	**1,300**	ND	14	3.8	2.7		
2	24-Sep-13	**1,800**	0.049 J	1.4	2.6	0.21		
3	21-Mar-14	**1,117**	ND	**19**	ND	ND		
4	25-Jun-14	**1,224**	ND	3.5	5.1	0.26		
5	15-Dec-14	**620**	ND	1.1	2.5	0.35		
6	8-Jun-15	**990**	<1.6	2	5.5	0.21		
7	7-Dec-15	**810**	<1.3	<1.3*	2.6	<1.3*		
8	6-Jun-16	**780**	<0.50	0.39	3.8	0.23		
9	7-Dec-16	**800**	<0.50	0.7	3.8	<0.50		
10	14-Jun-17	**670**	<0.50	0.42	3.7	<0.50		
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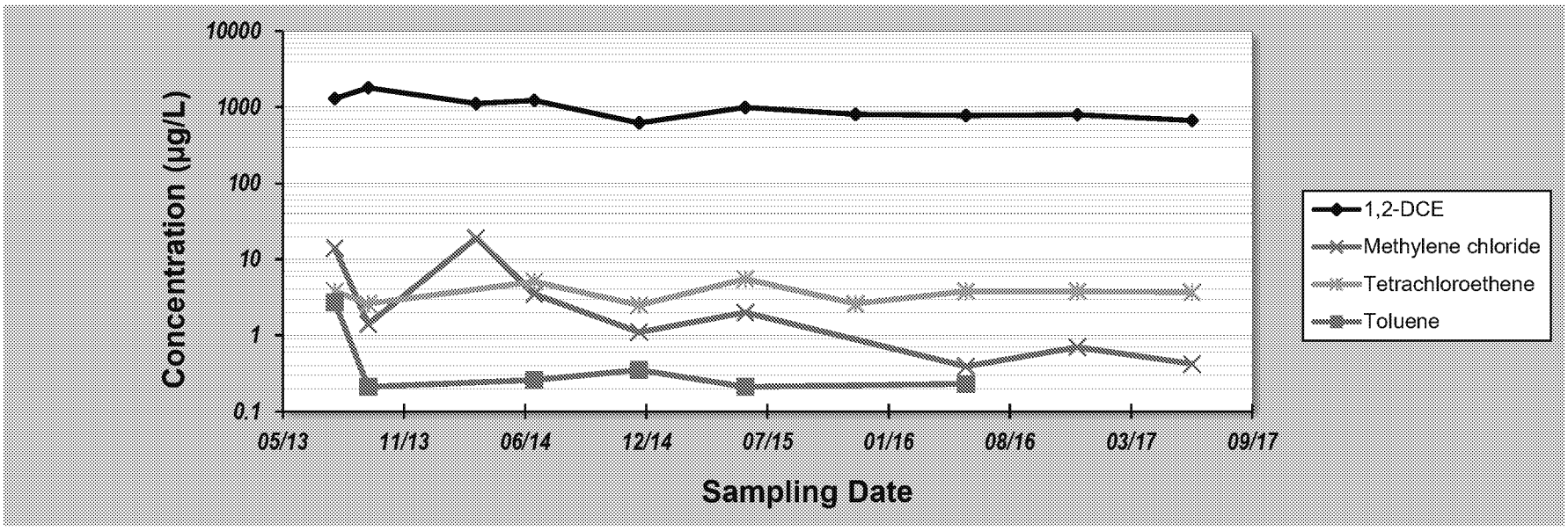
Coefficient of Variation:		0.36		1.45	0.29	1.52		
Mann-Kendall Statistic (S):		-29		-22	0	-4		
Confidence Factor:		99.5%		98.8%	46.0%	70.3%		
Concentration Trend:		Decreasing		Decreasing	Stable	No Trend		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	PRGS1b
Facility Name:	USACE	Constituent:	Sampling location PRGS Manhole
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION PRGS MANHOLE CONCENTRATION (µg/L)						
1	31-Jul-13	580	4.4	72	94			
2	24-Sep-13	1,200	2.6	**220**	38			
3	21-Mar-14	780	3	**210**	34			
4	25-Jun-14	460	3	**130**	29			
5	15-Dec-14	330	2.1	**95**	18			
6	8-Jun-15	410	3.2	**100**	24			
7	7-Dec-15	560	1.5	**110**	44			
8	6-Jun-16	570	2.4	**160**	13			
9	7-Dec-16	550	1.9	**110**	22			
10	14-Jun-17	490	1.8	**110**	31			
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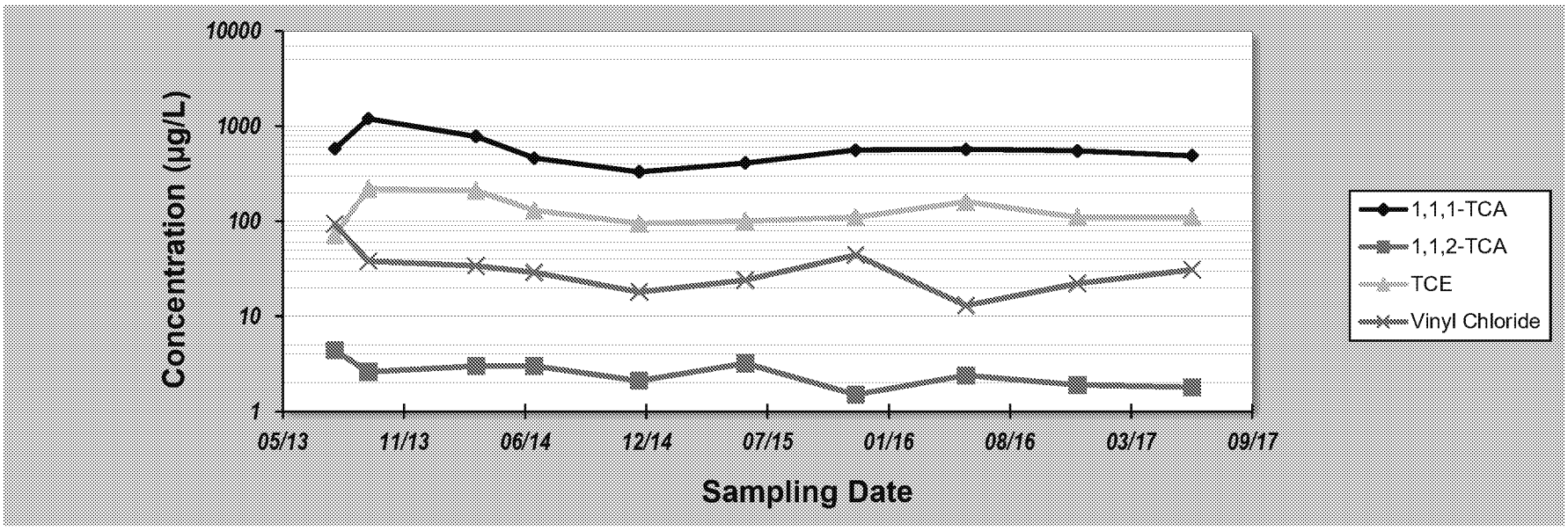
Coefficient of Variation:		0.41	0.33	0.38	0.66			
Mann-Kendall Statistic (S):		-13	-24	-2	-19			
Confidence Factor:		85.4%	98.2%	53.5%	94.6%			
Concentration Trend:		Stable	Decreasing	Stable	Prob. Decreasing			



Notes:

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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench7a
Facility Name:	USACE	Constituent:	Sampling location Trench 7
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 7 CONCENTRATION (µg/L)						
1	20-Jun-13	0.5	ND	0.11 J	ND	0.06		
2	23-Sep-13	2.1	ND	0.27 JB	ND	0.055 J		
3	18-Dec-13	1	ND R	0.066 J	ND R	0.053 J		
4	21-Mar-14	1.7	ND	0.033 J	ND	ND		
5	25-Jun-14	ND	ND	2.8 JB	ND UJ	1.7 JB		
6	15-Dec-14	0.56	ND	ND	ND	ND		
7	8-Jun-15	1.8	<0.50	<0.50	<0.50	0.04 J		
8	7-Dec-15	0.76	<0.50	<0.50	<0.50	<0.50*		
9	6-Jun-16	0.31	<0.50	<0.50	<0.50	<0.50		
10	7-Dec-16	<0.50	<0.50	<0.50	<0.50	<0.50		
11	14-Jun-17	<0.50	<0.50	<0.50	<0.50	<0.50		
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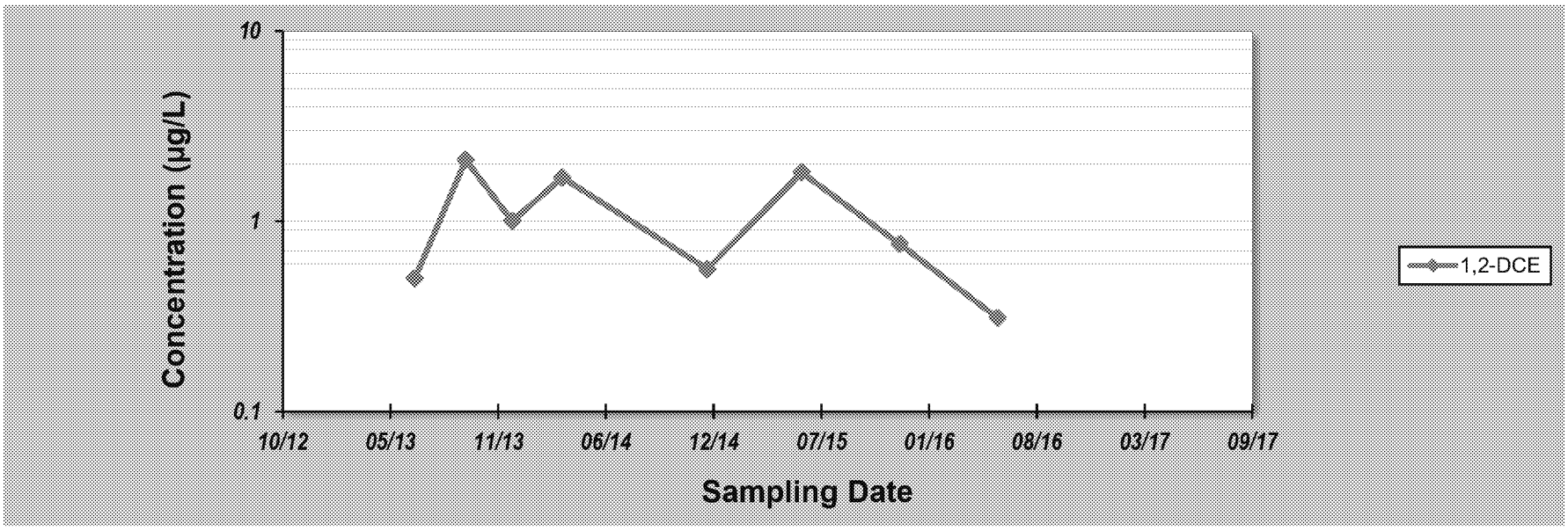
Coefficient of Variation:		0.62						
Mann-Kendall Statistic (S):		-6						
Confidence Factor:		72.6%						
Concentration Trend:		Stable						



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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench7b
Facility Name:	USACE	Constituent:	Sampling location Trench 7
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 7 CONCENTRATION (µg/L)						
1	20-Jun-13	1.1	ND	ND	ND			
2	23-Sep-13	0.78	ND	ND	5.2			
3	18-Dec-13	0.59	ND R	ND R	1.4			
4	21-Mar-14	0.18	ND	ND	ND			
5	25-Jun-14	ND	ND	ND	ND UJ			
6	15-Dec-14	0.29	ND	ND	ND			
7	8-Jun-15	<0.50	<0.50	<0.50	3.5			
8	7-Dec-15	0.45	<0.50	<0.50	0.52			
9	6-Jun-16	<0.50	<0.50	<0.50	0.57			
10	7-Dec-16	<0.50	<0.50	<0.50	<0.50			
11	14-Jun-17	<0.50	<0.50	<0.50	0.75			
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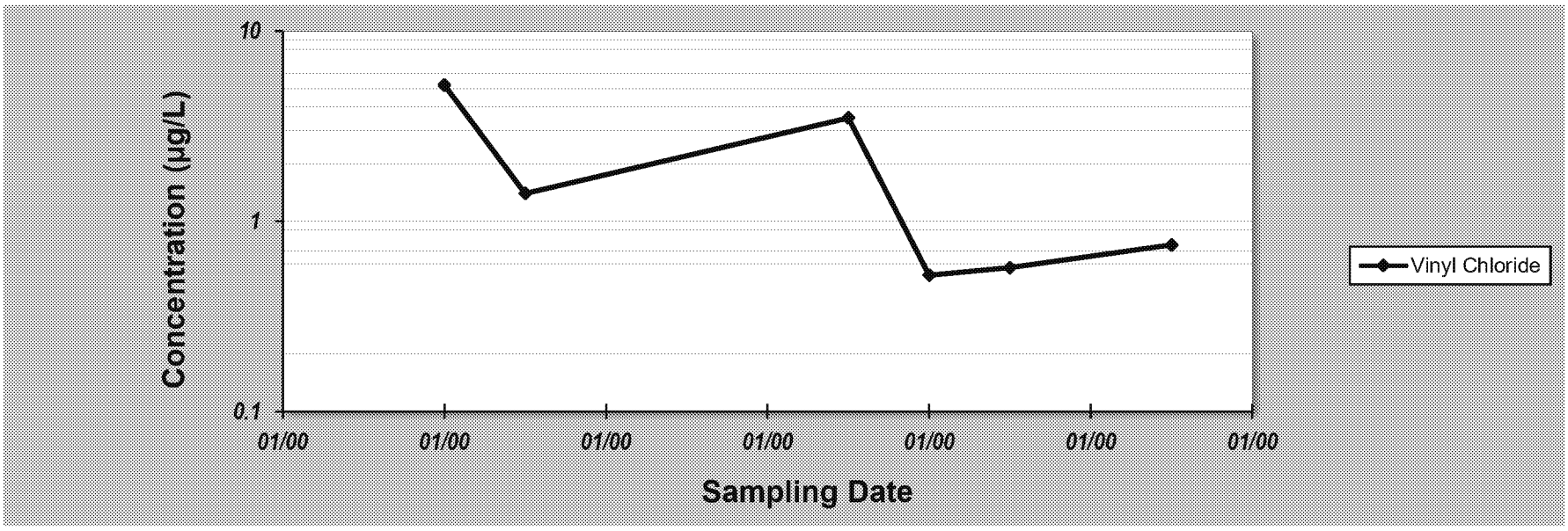
Coefficient of Variation:		0.60			0.97			
Mann-Kendall Statistic (S):		-9			7			
Confidence Factor:		93.2%			86.4%			
Concentration Trend:		Prob. Decreasing			Stable			



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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench6a
Facility Name:	USACE	Constituent:	Sampling location Trench 6
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 6 CONCENTRATION (µg/L)						
1	20-Jun-13	**970**	ND R	2.6	ND R	0.042		
2	31-Jul-13	**4,300**	ND	**220**	ND	9.9		
3	23-Sep-13	**1,100**	0.12 J	1.3	0.8	0.16		
4	18-Dec-13	**2,835**	ND	2.3	2.1	0.15		
5	21-Mar-14	**1,325**	ND	7	ND	ND		
6	25-Jun-14	**1,736**	ND UJ	**76**	4.3	1.6		
7	15-Dec-14	**2,700**	ND	3.3	6.9	ND		
8	8-Jun-15	**2,000**	2.1 J	<25	4.6	14		
9	7-Dec-15	**5,700**	<1.3*	<2.4	**14**	<1.3*		
10	6-Jun-16	**4,300**	<2.5	2.4	**11**	<2.5		
11	7-Dec-16	**4,400**	<2.5	<2.5	**9.8**	<2.5		
12	14-Jun-17	**4,400**	<2.5	<2.5	**12**	<2.5		
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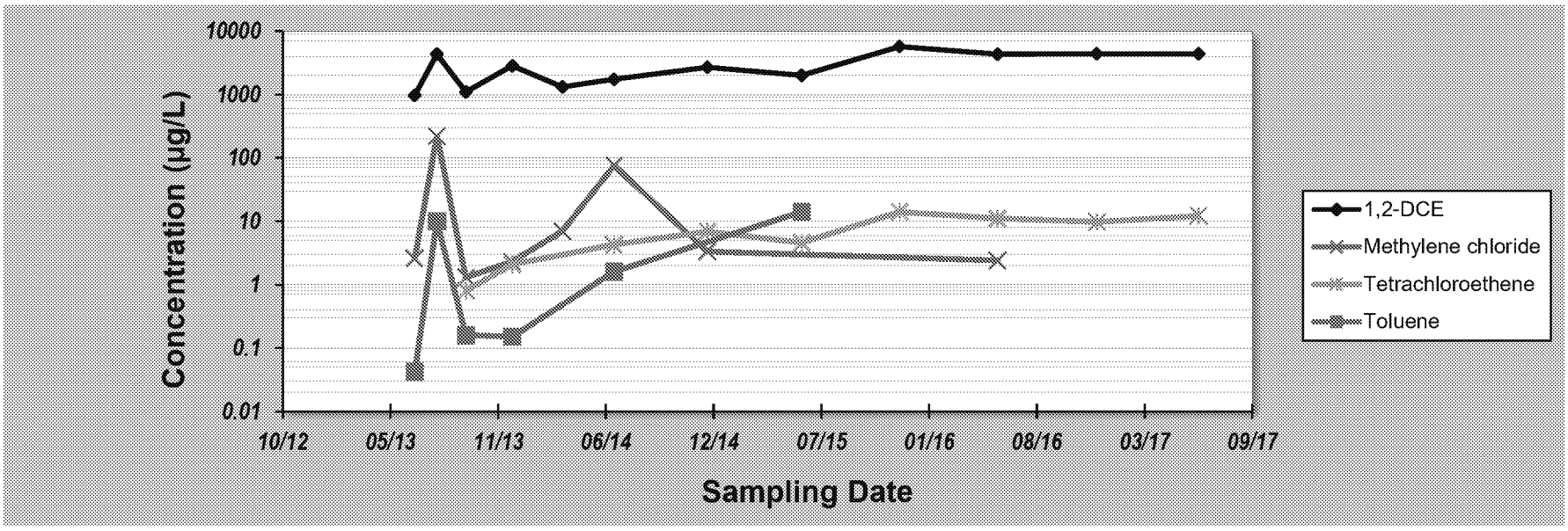
Coefficient of Variation:		0.53		1.96	0.64	1.41		
Mann-Kendall Statistic (S):		36		0	26	7		
Confidence Factor:		99.3%		45.2%	99.7%	86.4%		
Concentration Trend:		Increasing		No Trend	Increasing	No Trend		



Notes:

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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench6b
Facility Name:	USACE	Constituent:	Sampling location Trench 6
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 6 CONCENTRATION (µg/L)						
1	20-Jun-13	320	2.2	70	74			
2	31-Jul-13	3,000	13	**450**	93			
3	23-Sep-13	650	2.7	38	29			
4	18-Dec-13	2,000	4.1	**110**	94			
5	21-Mar-14	660	3.1	**220**	100			
6	25-Jun-14	780	7	**210**	76			
7	15-Dec-14	1,800	5.2	**620**	77			
8	8-Jun-15	1,300	<25	**330**	78			
9	7-Dec-15	5,100	6.2	**1300**	140			
10	6-Jun-16	5,000	6.3	**1200**	47			
11	7-Dec-16	3,000	4.5	**480**	63			
12	14-Jun-17	4,000	6.6	**1400**	63			
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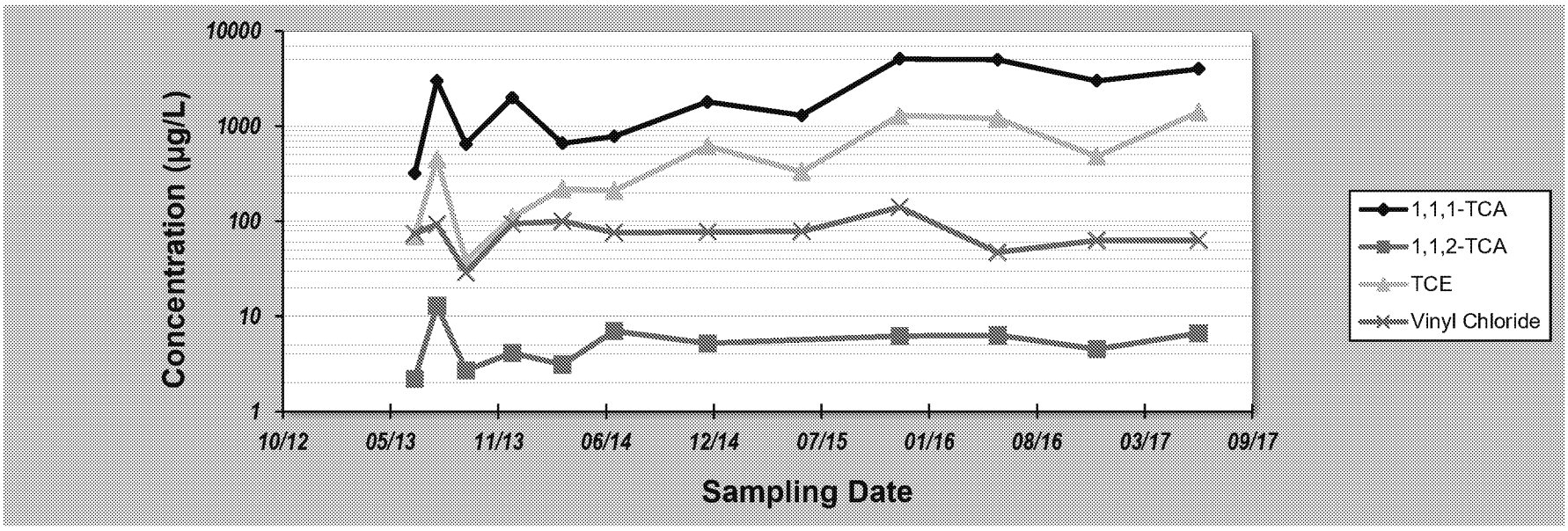
Coefficient of Variation:		0.74	0.84	0.92	0.36			
Mann-Kendall Statistic (S):		33	19	42	-5			
Confidence Factor:		98.7%	91.8%	99.8%	60.6%			
Concentration Trend:		Increasing	Prob. Increasing	Increasing	Stable			



Notes:

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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench5a
Facility Name:	USACE	Constituent:	Sampling location Trench 5
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 5 CONCENTRATION (µg/L)						
1	20-Jun-13	**850**	ND	4.8	**12**	ND		
2	31-Jul-13	**930**	ND	**37**	7.6	2.5		
3	23-Sep-13	**350**	0.066 J	0.44	3.6	35		
4	18-Dec-13	**447.2**	ND	0.28	3.9	0.11		
5	21-Mar-14	**979.9**	ND	12	4	ND		
6	25-Jun-14	**1,114**	ND UJ	3.1	**11**	2.1		
7	15-Dec-14	**450**	ND	0.56	3.5	0.15		
8	8-Jun-15	**640**	1.3 U	0.38	5.2	1.3		
9	7-Dec-15	300	<4.2	<0.50*	3.5	<4.2		
10	6-Jun-16	**830**	<0.50	0.26	3.5	<0.50		
11	7-Dec-16	230	<0.50	<0.50	2.6	<0.50		
12	29-Jun-17	**500**	2.5	2.5	3.9	2.5		
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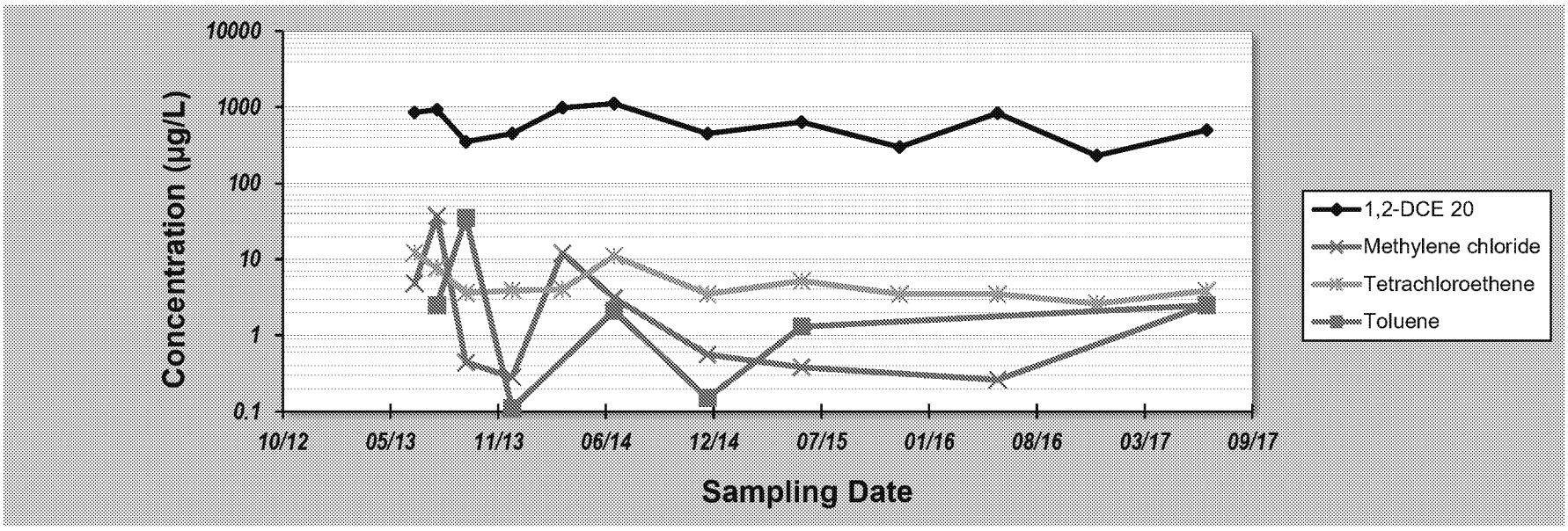
Coefficient of Variation:		0.47		1.86	0.59	2.04		
Mann-Kendall Statistic (S):		-14		-17	-30	-2		
Confidence Factor:		81.0%		92.2%	97.8%	55.7%		
Concentration Trend:		Stable		Prob. Decreasing	Decreasing	No Trend		



Notes:

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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench5b
Facility Name:	USACE	Constituent:	Sampling location Trench 5
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 5 CONCENTRATION (µg/L)						
1	20-Jun-13	170	6.2	9.6	ND			
2	31-Jul-13	150	5.8	8.9	ND			
3	23-Sep-13	61	2.9	4.9	24			
4	18-Dec-13	69	4.1	3.4	0.79			
5	21-Mar-14	200	4.9	36	2.7			
6	25-Jun-14	170	4.7	17	ND UJ			
7	15-Dec-14	57	2.5	5.4	3.8			
8	8-Jun-15	130	2.5	11	7			
9	7-Dec-15	57	1.7	6.6	5.3			
10	6-Jun-16	140	2.7	6.9	14			
11	7-Dec-16	52	1.6	3.7	<0.50			
12	29-Jun-17	95	2.1	5.7	2.5			
13								
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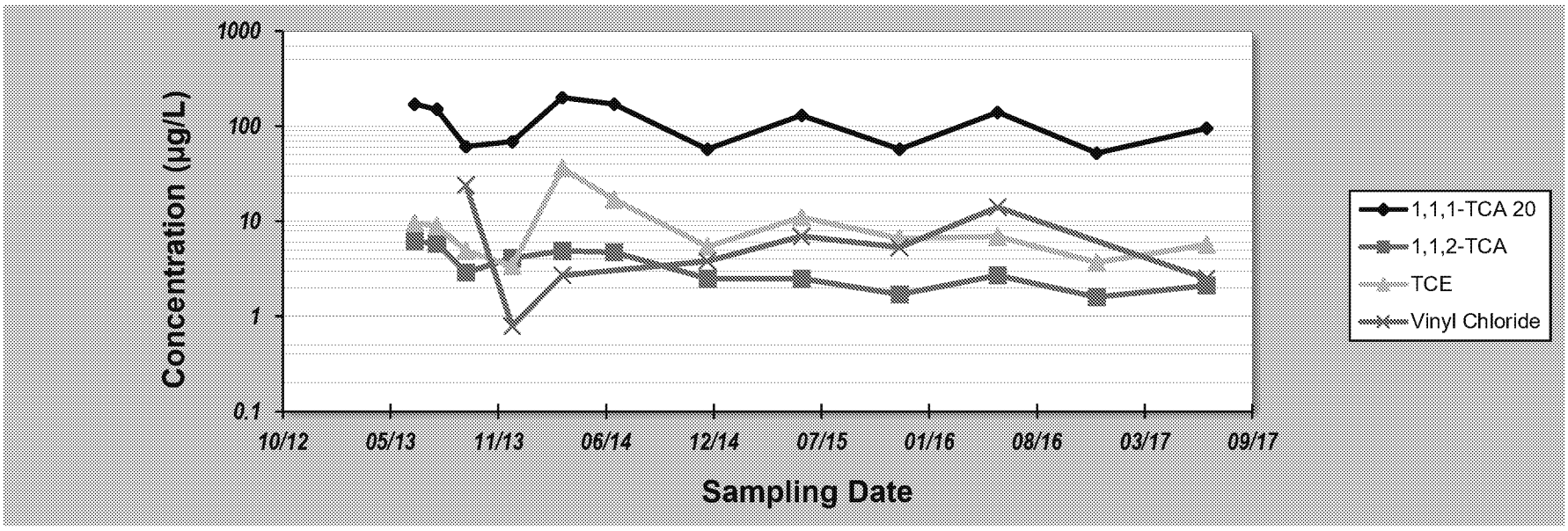
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.47	0.46	0.91	1.04			
Mann-Kendall Statistic (S):		-22	-45	-12	2			
Confidence Factor:		92.4%	100.0%	77.0%	54.8%			
Concentration Trend:		Prob. Decreasing	Decreasing	Stable	No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench4a
Facility Name:	USACE	Constituent:	Sampling location Trench 4
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 4 CONCENTRATION (µg/L)						
1	20-Jun-13	**870**	ND	**39**	**10**	1.5		
2	23-Sep-13	**340**	ND	0.46	2.1	0.096		
3	18-Dec-13	**498.3**	ND	0.31	3.6	0.034		
4	21-Mar-14	**949.2**	ND	11	3.4	ND		
5	25-Jun-14	**1,114**	ND UJ	3.5	8.6	2.1		
6	15-Dec-14	**460**	ND	0.63	3.6	ND		
7	8-Jun-15	**670**	1.3 U	0.32	4.2	1.3		
8	7-Dec-15	**280**	<3.6	<3.6*	2.8	<3.6		
9	6-Jun-16	**1,100**	<0.50	0.46	3.7	<0.50		
10	7-Dec-16	260	<0.50	<0.50	2.5	<0.50		
11	14-Jun-17	170	<0.50	<0.50	1.12	<0.50		
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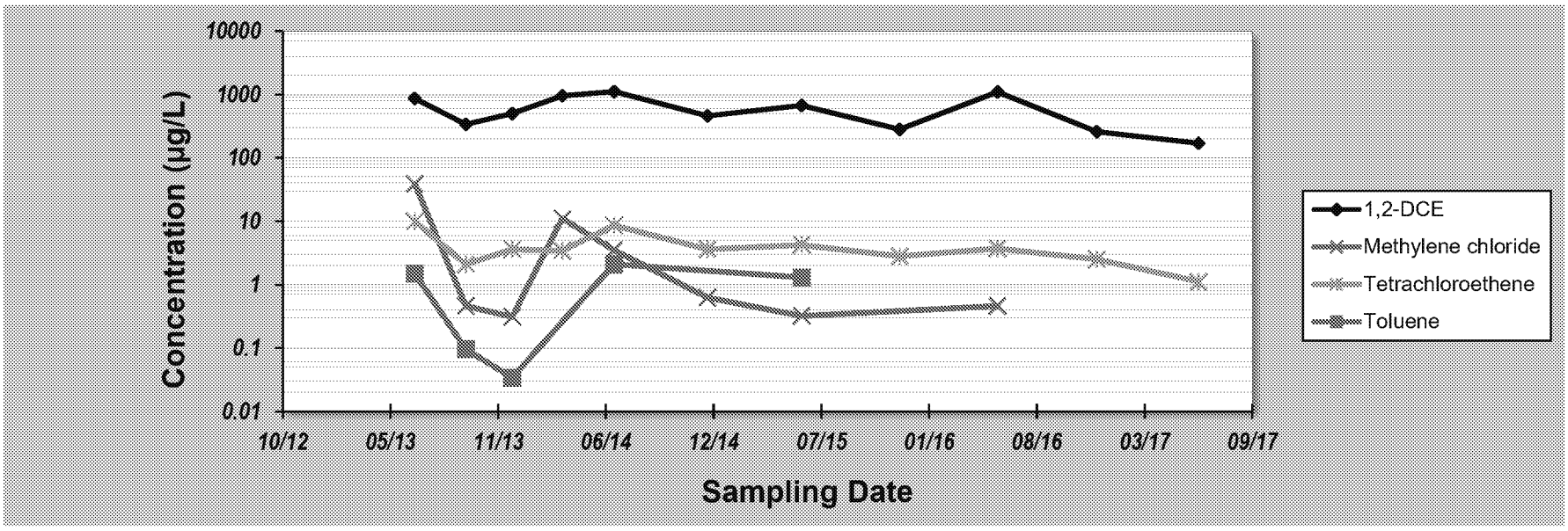
Coefficient of Variation:		0.57		1.93	0.65	0.90		
Mann-Kendall Statistic (S):		-17		-9	-18	0		
Confidence Factor:		89.1%		83.2%	90.5%	40.8%		
Concentration Trend:		Stable		No Trend	Prob. Decreasing	Stable		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench4b
Facility Name:	USACE	Constituent:	Sampling location Trench 4
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 4 CONCENTRATION (µg/L)						
1	20-Jun-13	160	6.3	8.3	ND			
2	23-Sep-13	33	2.6	3	17			
3	18-Dec-13	75	4.5	3.3	0.69			
4	21-Mar-14	190	4.9	28	3.6			
5	25-Jun-14	170	4.9	16	3.4			
6	15-Dec-14	61	3	5.2	3.7			
7	8-Jun-15	140	2.5	8.5	5.5			
8	7-Dec-15	52	1.8	5.3	1.3			
9	6-Jun-16	160	3	7.4	15			
10	7-Dec-16	52	1.7	3.6	0.51			
11	14-Jun-17	25	1.9	2.8	<0.50			
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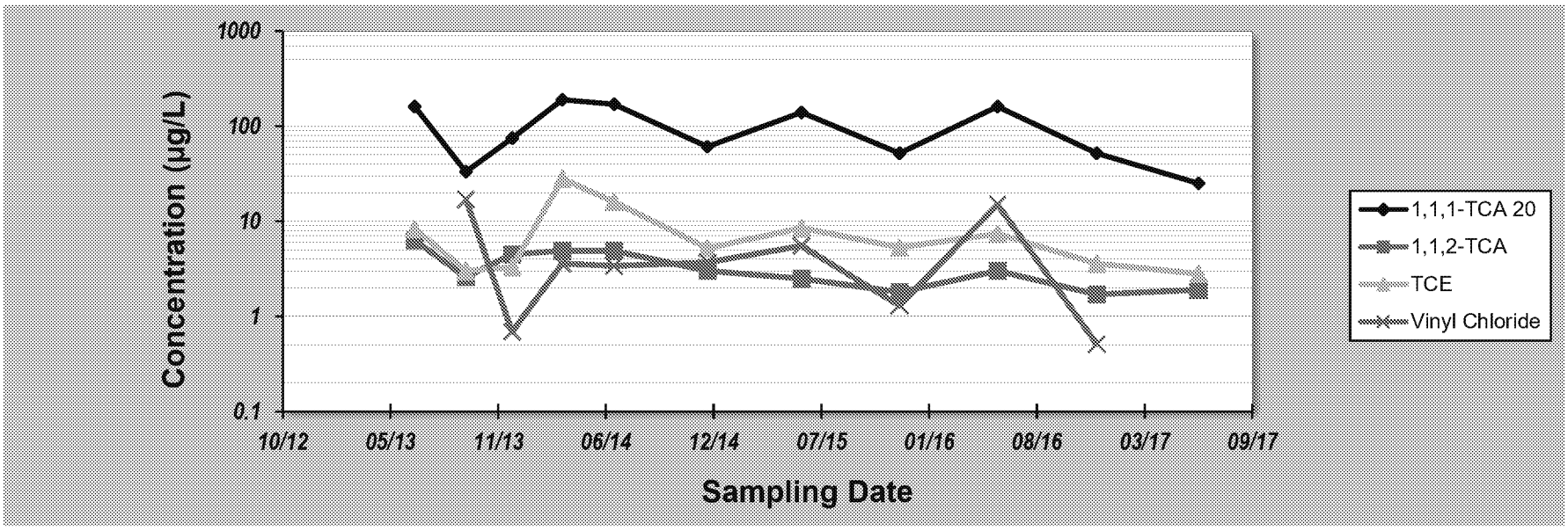
20								
Coefficient of Variation:		0.61	0.46	0.91	1.09			
Mann-Kendall Statistic (S):		-17	-31	-11	-4			
Confidence Factor:		89.1%	99.2%	77.7%	61.9%			
Concentration Trend:		Stable	Decreasing	Stable	No Trend			



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench3a
Facility Name:	USACE	Constituent:	Sampling location Trench 3
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 3 CONCENTRATION (µg/L)						
1	20-Jun-13	**990**	ND	2.1	**10**	1.8		
2	31-Jul-13	**1,000**	5	**55**	4.6	6.1		
3	23-Sep-13	**990**	8.4	0.94	3.5	4.3		
4	18-Dec-13	**705**	0.85	0.52	3.9	0.43		
5	21-Mar-14	**1,111**	ND	**18**	5.8	ND		
6	25-Jun-14	**1,115**	8.2	2.8	**10**	2.9		
7	15-Dec-14	33	ND	0.057	0.25	ND		
8	8-Jun-15	**1,200**	0.25	0.32	5.1	7.7		
9	7-Dec-15	**440**	<1.0	<1.0*	5.7	<1.0*		
10	6-Jun-16	**1500**	0.52	1.3	4.7	35		
11	7-Dec-16	**360**	<0.50	<0.50	3.4	<0.50		
12	14-Jun-17	**510**	<0.50	<0.50	4.9	<0.50		
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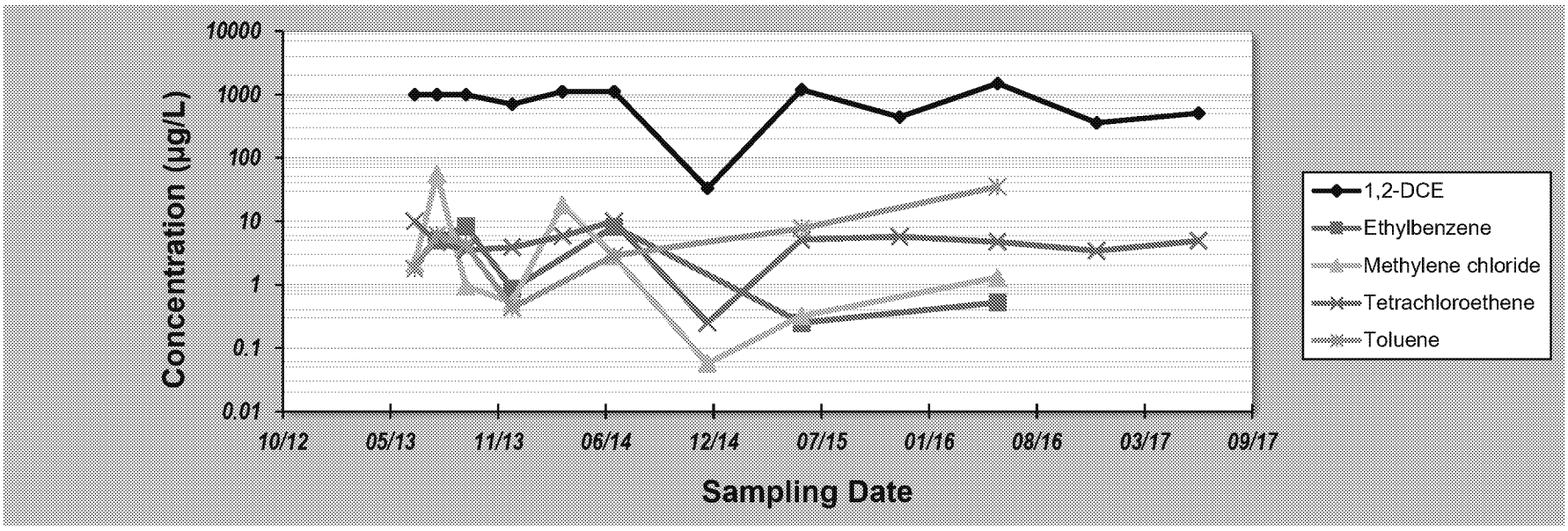
Coefficient of Variation:		0.51	0.99	2.02	0.52	1.45		
Mann-Kendall Statistic (S):		-3	-7	-12	-9	9		
Confidence Factor:		55.4%	86.4%	87.0%	70.4%	68.1%		
Concentration Trend:		Stable	Stable	No Trend	Stable	No Trend		



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench3b
Facility Name:	USACE	Constituent:	Sampling location Trench 3
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 3 CONCENTRATION (µg/L)						
1	20-Jun-13	160	ND	6.4	100			
2	31-Jul-13	300	**45**	6.3	290			
3	23-Sep-13	220	35	5	430			
4	18-Dec-13	130	4.2	3	11			
5	21-Mar-14	230	ND	30	15			
6	25-Jun-14	170	ND	14	110			
7	15-Dec-14	4.1	ND	0.3	0.33			
8	8-Jun-15	180	1.6	11	80			
9	7-Dec-15	97	0.61	9.5	39			
10	6-Jun-16	230	1.5	13	98			
11	7-Dec-16	87	<0.50	3.9	29			
12	14-Jun-17	120	2.5	5	36			
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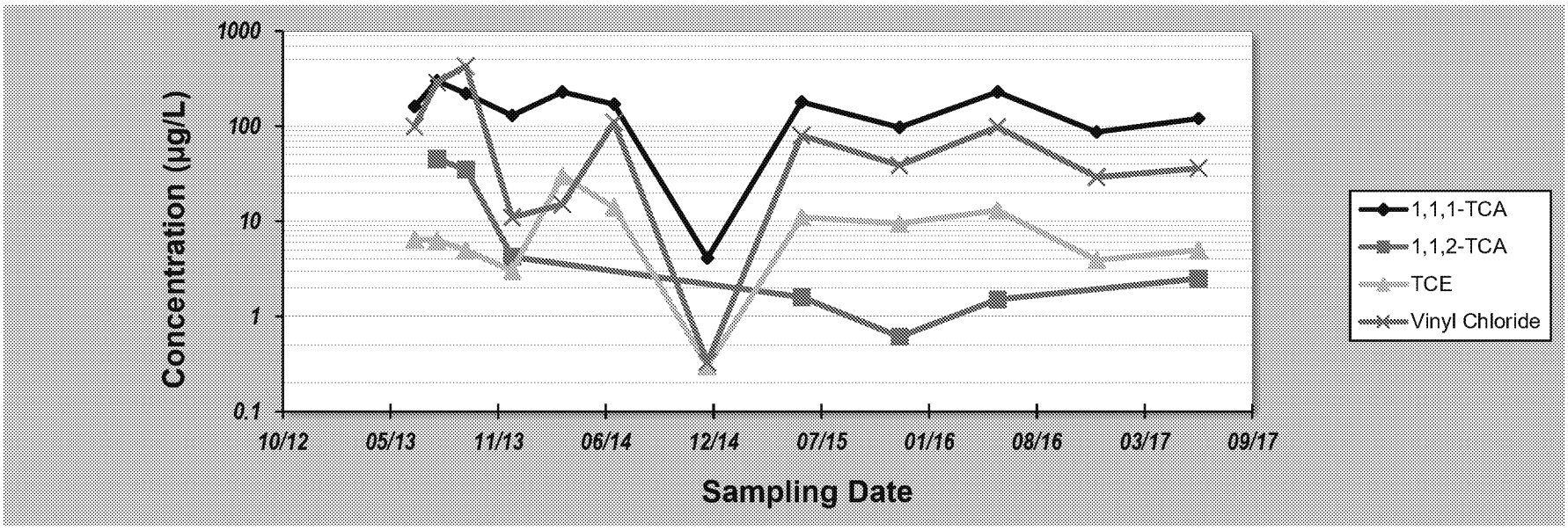
Coefficient of Variation:		0.50	1.45	0.87	1.25			
Mann-Kendall Statistic (S):		-19	-13	-5	-16			
Confidence Factor:		88.9%	96.5%	60.6%	84.5%			
Concentration Trend:		Stable	Decreasing	Stable	No Trend			



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench2a
Facility Name:	USACE	Constituent:	Sampling location Trench 2
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 2 CONCENTRATION (µg/L)						
1	20-Jun-13	**3,100**	28	6.7	8.4	110		
2	31-Jul-13	**5,800**	41	**140**	ND	290		
3	23-Sep-13	**2,400**	50	0.88	2.7	520		
4	18-Dec-13	**2,646**	18	2	5.8	64		
5	21-Mar-14	**3,634**	8.9	**84**	**13**	72		
6	25-Jun-14	**3,132**	32	1.4	**11**	140		
7	15-Dec-14	**1,300**	6.3	2.9	6.7	16		
8	8-Jun-15	**3,700**	40	<25	**15**	630		
9	7-Dec-15	**820**	7.6	<1.3*	**9**	46		
10	6-Jun-16	**6,300**	46	**22**	6	460		
11	7-Dec-16	**1,100**	18	0.78	5	76		
12	14-Jun-17	**4,600**	34	2.5	5	5.4		
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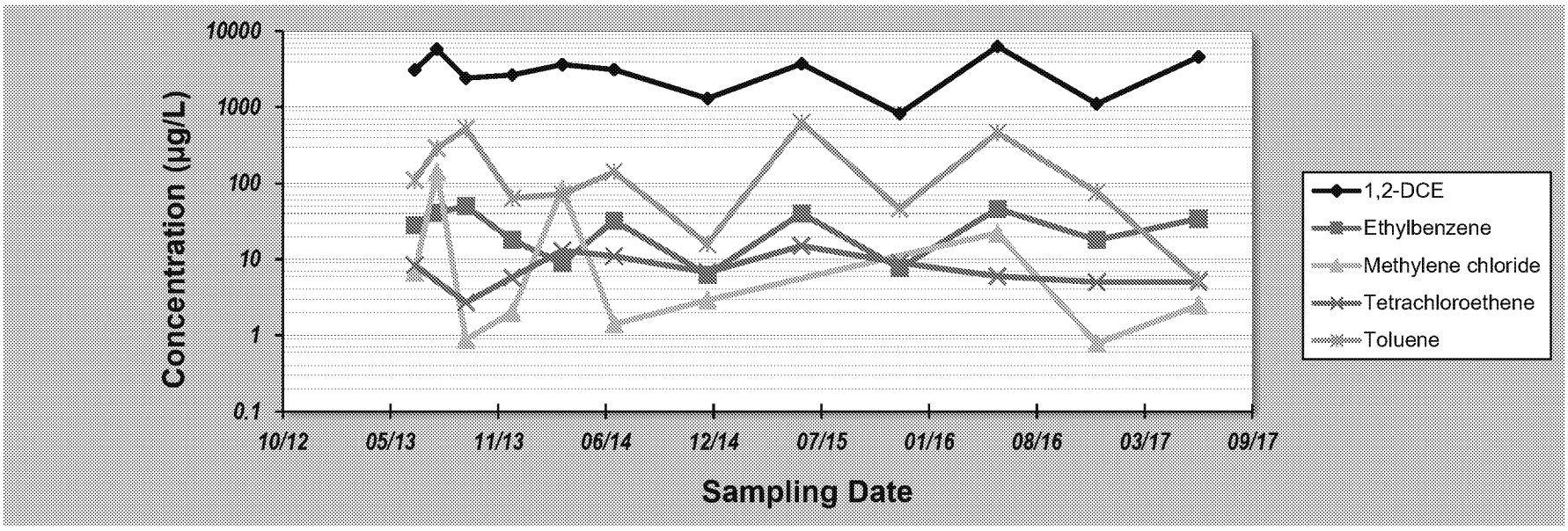
19								
20								
Coefficient of Variation:		0.54	0.56	1.80	0.47	1.07		
Mann-Kendall Statistic (S):		0	-5	-9	-8	-14		
Confidence Factor:		47.3%	60.6%	75.8%	70.3%	81.0%		
Concentration Trend:		Stable	Stable	No Trend	Stable	No Trend		



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench2b
Facility Name:	USACE	Constituent:	Sampling location Trench 2
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 2 CONCENTRATION (µg/L)						
1	20-Jun-13	590	ND	ND	420			
2	31-Jul-13	810	ND	ND	**1,600**			
3	23-Sep-13	380	3.7	2.7	**1,900**			
4	18-Dec-13	400	2.4	3.4	460			
5	21-Mar-14	830	3.7	60	350			
6	25-Jun-14	470	3	13	350			
7	15-Dec-14	170	1.6	7.6	55			
8	8-Jun-15	730	<25	31	230			
9	7-Dec-15	190	0.86	23	290			
10	6-Jun-16	1200	4.9	61	**540**			
11	7-Dec-16	180	0.79	7.5	190			
12	14-Jun-17	410	2.2	4.2	470			
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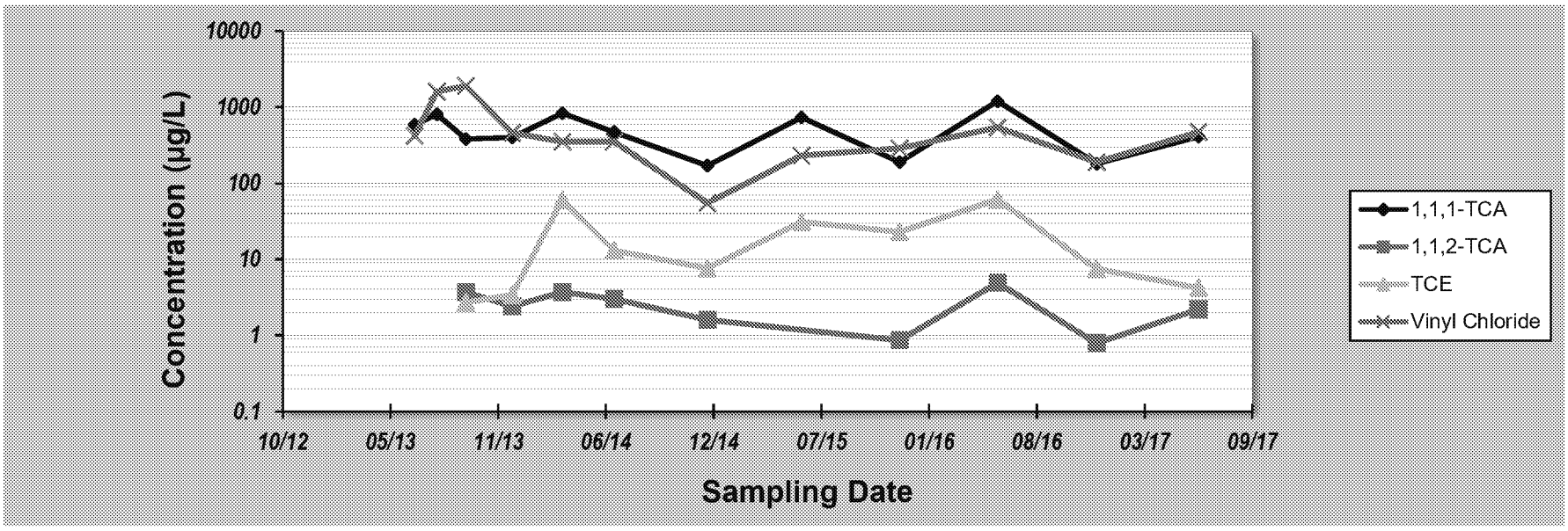
18								
19								
20								
Coefficient of Variation:		0.59	0.84	1.06	1.00			
Mann-Kendall Statistic (S):		-8	-13	7	-19			
Confidence Factor:		68.1%	89.0%	70.0%	88.9%			
Concentration Trend:		Stable	Stable	No Trend	Stable			



Notes:

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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench1a
Facility Name:	USACE	Constituent:	Sampling location Trench 1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 1 CONCENTRATION (µg/L)						
1	20-Jun-13	**8,700**	ND	**76**	ND	16		
2	31-Jul-13	**5,900**	ND	**71**	ND	9.3		
3	23-Sep-13	**4,000**	0.13 J	1.1	7.8	2.3		
4	18-Dec-13	**3772**	0.057 J	7.3	**10**	1.2		
5	21-Mar-14	**7,420**	ND	ND	6.5	6.1		
6	25-Jun-14	**7,700**	ND UJ	4.5	**13**	5.3		
7	15-Dec-14	**3,600**	ND	0.99	**14**	1		
8	8-Jun-15	**4,200**	<25	<25	**13**	3.6		
9	7-Dec-15	**3,300**	<1.3	<1.3*	**11**	<1.3*		
10	6-Jun-16	**2,600**	<0.50	1	**21**	3		
11	7-Dec-16	**2,000**	<0.50	<0.50	**16**	1.9		
12	14-Jun-17	**1,700**	<0.50	<0.50	**18**	1.8		
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14								
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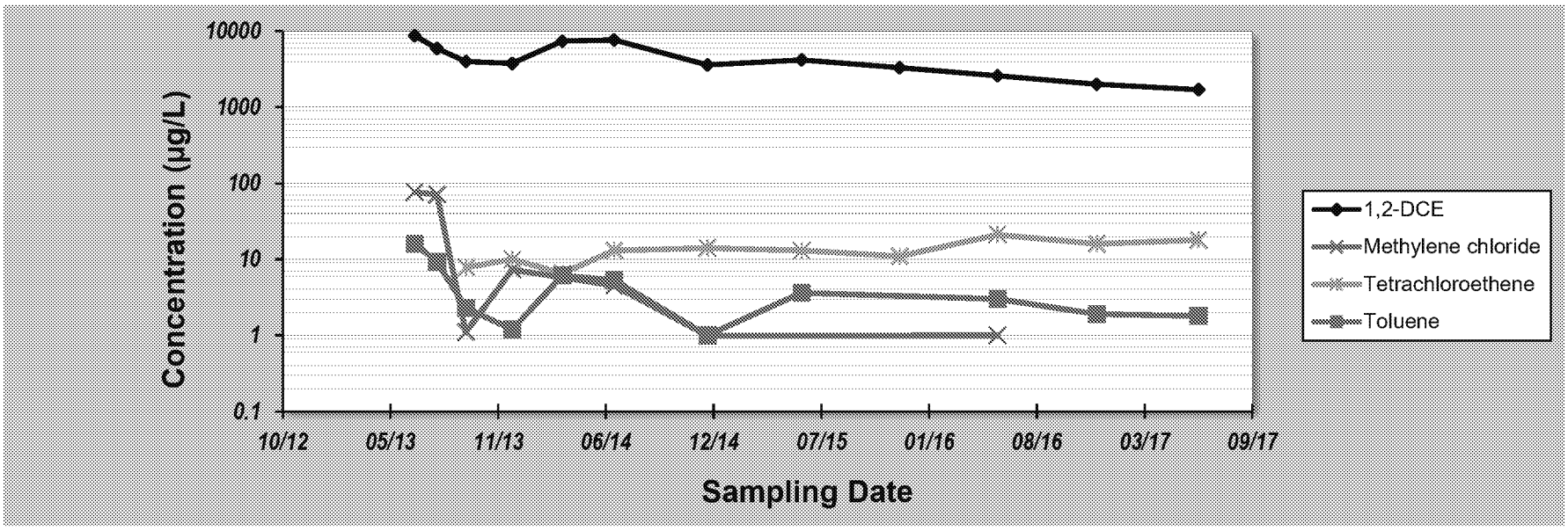
16								
17								
18								
19								
20								
Coefficient of Variation:		0.51		1.49	0.34	0.96		
Mann-Kendall Statistic (S):		-46		-15	28	-27		
Confidence Factor:		100.0%		98.5%	99.4%	98.0%		
Concentration Trend:		Decreasing		Decreasing	Increasing	Decreasing		



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	Trench1b
Facility Name:	USACE	Constituent:	Sampling location Trench 1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION TRENCH 1 CONCENTRATION (µg/L)						
1	20-Jun-13	260	ND	ND	**1,900**			
2	31-Jul-13	190	ND	17	**1,900**			
3	23-Sep-13	170	1.1	13	**940**			
4	18-Dec-13	140	1.2	14	**720**			
5	21-Mar-14	310	ND	9.8	**1,600**			
6	25-Jun-14	160	1.7	24	**1,700**			
7	15-Dec-14	110	1.2	17	290			
8	8-Jun-15	120	<25	24	410			
9	7-Dec-15	240	1.2	12	**590**			
10	6-Jun-16	140	0.79	26	**610**			
11	7-Dec-16	120	0.79	17	440			
12	14-Jun-17	100	0.51	23	280			
13								
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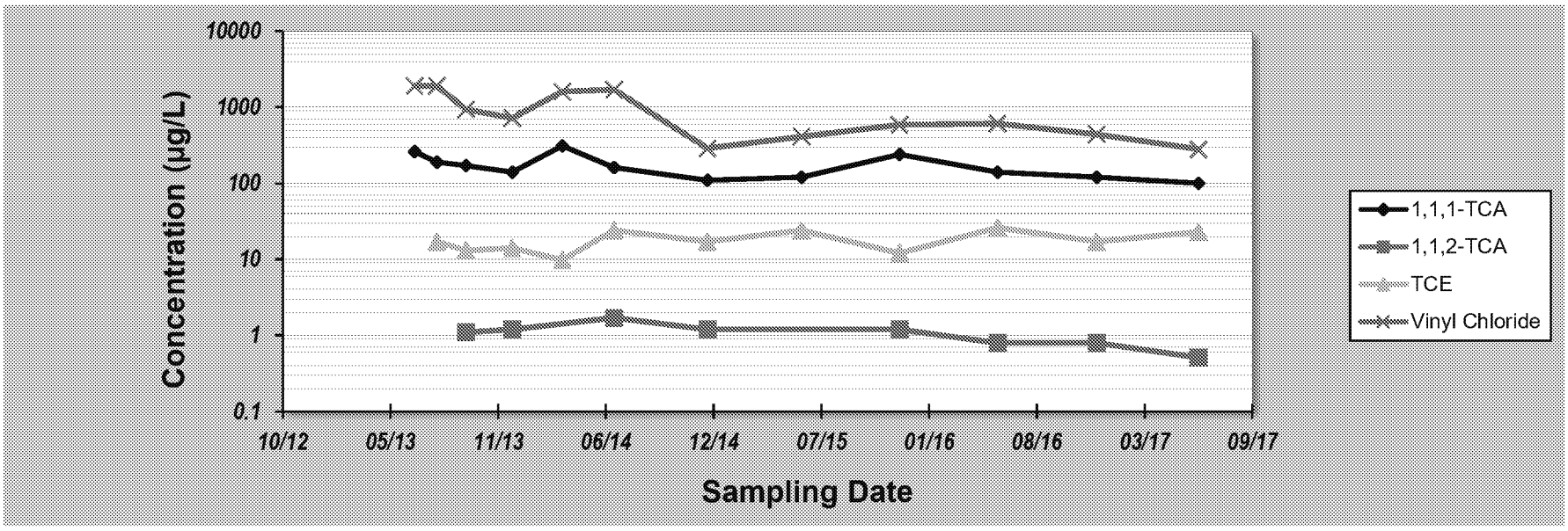
20								
Coefficient of Variation:		0.39	0.34	0.31	0.68			
Mann-Kendall Statistic (S):		-34	-14	15	-39			
Confidence Factor:		99.0%	94.6%	85.9%	99.7%			
Concentration Trend:		Decreasing	Prob. Decreasing	No Trend	Decreasing			



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	MW14a
Facility Name:	USACE	Constituent:	Sampling location MW-14
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION MW-14 CONCENTRATION (µg/L)						
1	20-Jun-13	59	ND	0.28 JB	ND	0.090 J		
2	24-Sep-13	57	ND	0.24 JB	ND	0.069 JB		
3	31-Jan-14	64	ND	ND	ND	0.037 J		
4	20-Mar-14	50	ND	ND	ND	ND		
5	26-Jun-14	45	ND UJ	0.039 JB	ND UJ	0.044 JB		
6	16-Dec-14	58	ND	ND	ND	0.033 J		
7	9-Jun-15	45	<0.50	<0.50*	<0.50	<0.50*		
8	9-Dec-15	77	<0.50	<0.50	<0.50	<0.50*		
9	7-Jun-16	49	<0.50	0.22 J	<0.50	<0.50		
10	6-Dec-16	65	<0.50	<0.50	<0.50	<0.50		
11	13-Jun-17	19	<0.50	<0.50	<0.50	<0.50		
12								
13								
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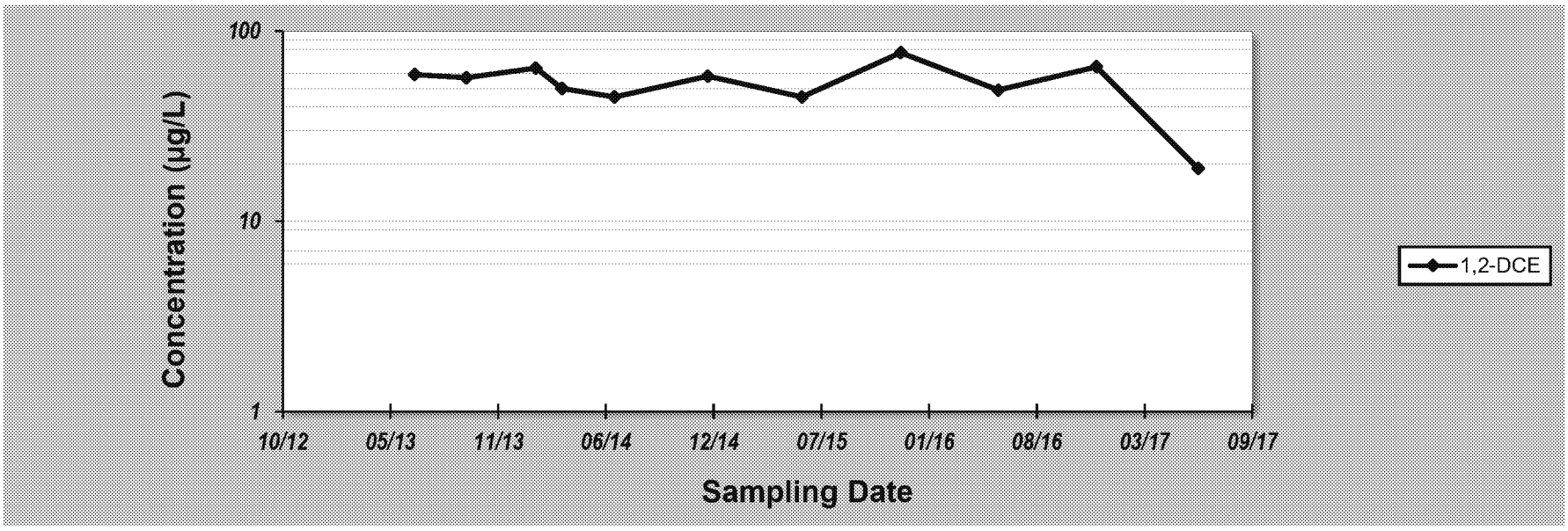
Coefficient of Variation:		0.28						
Mann-Kendall Statistic (S):		-10						
Confidence Factor:		75.3%						
Concentration Trend:		Stable						



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	MW14b
Facility Name:	USACE	Constituent:	Sampling location MW-14
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION MW-14 CONCENTRATION (µg/L)						
1	20-Jun-13	ND	ND	ND	25			
2	24-Sep-13	ND	ND	ND	21			
3	31-Jan-14	ND	ND	ND	23			
4	20-Mar-14	ND	ND	ND	17			
5	26-Jun-14	ND	ND	ND	15			
6	16-Dec-14	ND	ND	ND	19			
7	9-Jun-15	<0.70	<0.70	<0.70	15			
8	9-Dec-15	<0.84	<0.84	<0.84	17			
9	7-Jun-16	<0.50	<0.50	<0.50	13			
10	6-Dec-16	<0.50	<0.50	<0.50	15			
11	13-Jun-17	<0.50	<0.50	<0.50	13			
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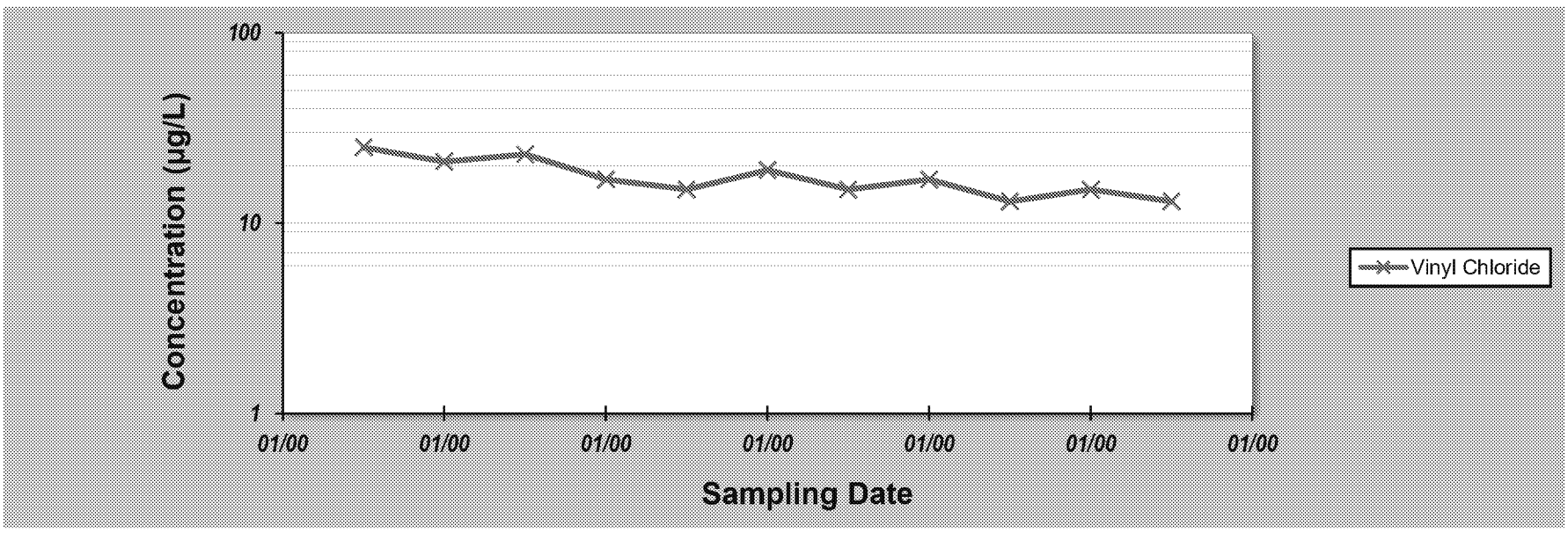
19								
20								
Coefficient of Variation:				0.23			
Mann-Kendall Statistic (S):				-38			
Confidence Factor:				99.9%			
Concentration Trend:				Decreasing			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S6a
Facility Name:	USACE	Constituent:	Sampling location S-6
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION S-6 CONCENTRATION (µg/L)						
1	19-Jun-13	ND	ND	0.28 JB	ND	0.090 J		
2	23-Sep-13	2.4	ND	0.24 JB	ND	0.069 JB		
3	31-Jan-14	ND	ND	ND	ND	0.037 J		
4	20-Mar-14	0.72	ND	ND	ND	ND		
5	25-Jun-14	0.74	ND UJ	0.039 JB	ND UJ	0.044 JB		
6	16-Dec-14	0.57	ND	ND	ND	0.033 J		
7	9-Jun-15	0.48	<0.50	<0.50*	<0.50	<0.50*		
8	9-Dec-15	0.79	<0.50	<0.50	<0.50	<0.50*		
9	14-Jun-16	1.4	<0.50	0.22 J	<0.50	<0.50		
10	6-Dec-16	2.9	<0.50	<0.50	<0.50	<0.50		
11	14-Jun-17	3.9	<0.50	<0.50	<0.50	<0.50		
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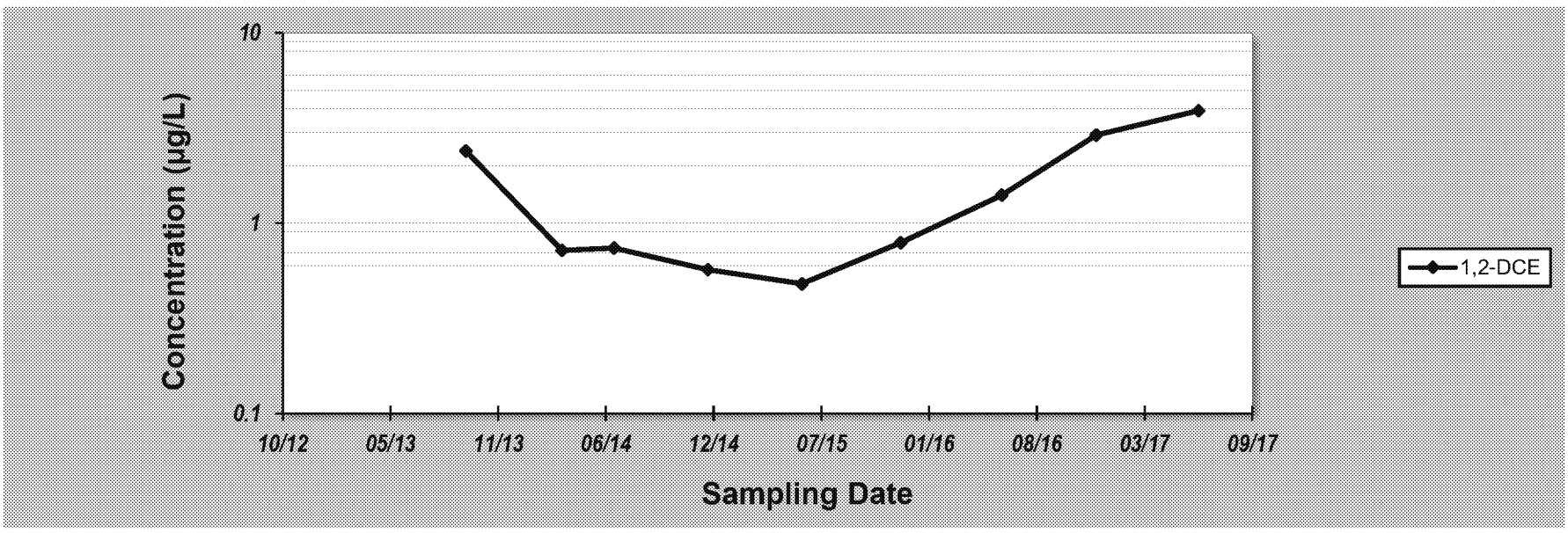
Coefficient of Variation:		0.80						
Mann-Kendall Statistic (S):		14						
Confidence Factor:		91.0%						
Concentration Trend:		Prob. Increasing						



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S6b
Facility Name:	USACE	Constituent:	Sampling location S-6
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION S-6 CONCENTRATION (µg/L)						
1	19-Jun-13	ND	ND	ND	1.9			
2	23-Sep-13	ND	ND	ND	0.49			
3	31-Jan-14	ND	ND	ND	ND			
4	20-Mar-14	ND	ND	ND	0.62			
5	25-Jun-14	ND	ND	ND	0.5			
6	16-Dec-14	ND	ND	ND	0.31			
7	9-Jun-15	<0.50	<0.50	<0.50	0.43			
8	9-Dec-15	<0.50	<0.50	<0.50	0.78			
9	14-Jun-16	<0.50	<0.50	<0.50	0.6			
10	6-Dec-16	<0.50	<0.50	<0.50	1.0			
11	14-Jun-17	<0.50	<0.50	<0.50	1.0			
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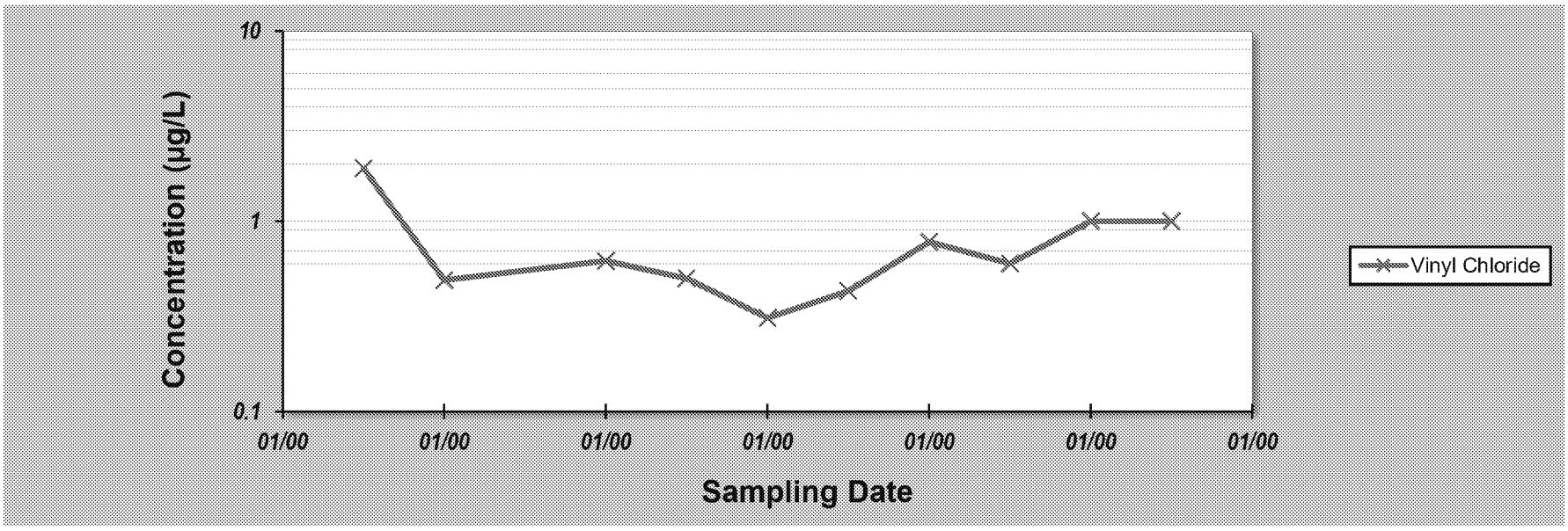
Coefficient of Variation:				0.60			
Mann-Kendall Statistic (S):				8			
Confidence Factor:				72.9%			
Concentration Trend:				No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S5a
Facility Name:	USACE	Constituent:	Sampling location S-5
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION S-5 CONCENTRATION (µg/L)						
1	20-Jun-13	8.4	ND	0.18 JB	ND	0.075 J		
2	24-Sep-13	0.31	ND	0.20 JB	ND	0.038 JB		
3	19-Dec-13	0.39	ND	0.061 JB	ND	0.068 J		
4	19-Mar-14	0.98	ND	ND	ND	ND		
5	25-Jun-14	0.13	ND UJ	0.068 JB	ND UJ	0.057 JB		
6	16-Dec-14	0.34	ND	ND	ND	0.030 J		
7	9-Jun-15	0.6	<0.50	<0.50	<0.50	<0.50*		
8	9-Dec-15	0.62	<0.50	<0.50	<0.50	<0.50		
9	7-Jun-16	0.9	<0.50	<0.50	<0.50	<0.50		
10	6-Dec-16	1.2	<0.50	<0.50	<0.50	<0.50		
11	14-Jun-17	6.1	<0.50	<0.50	<0.50	<0.50		
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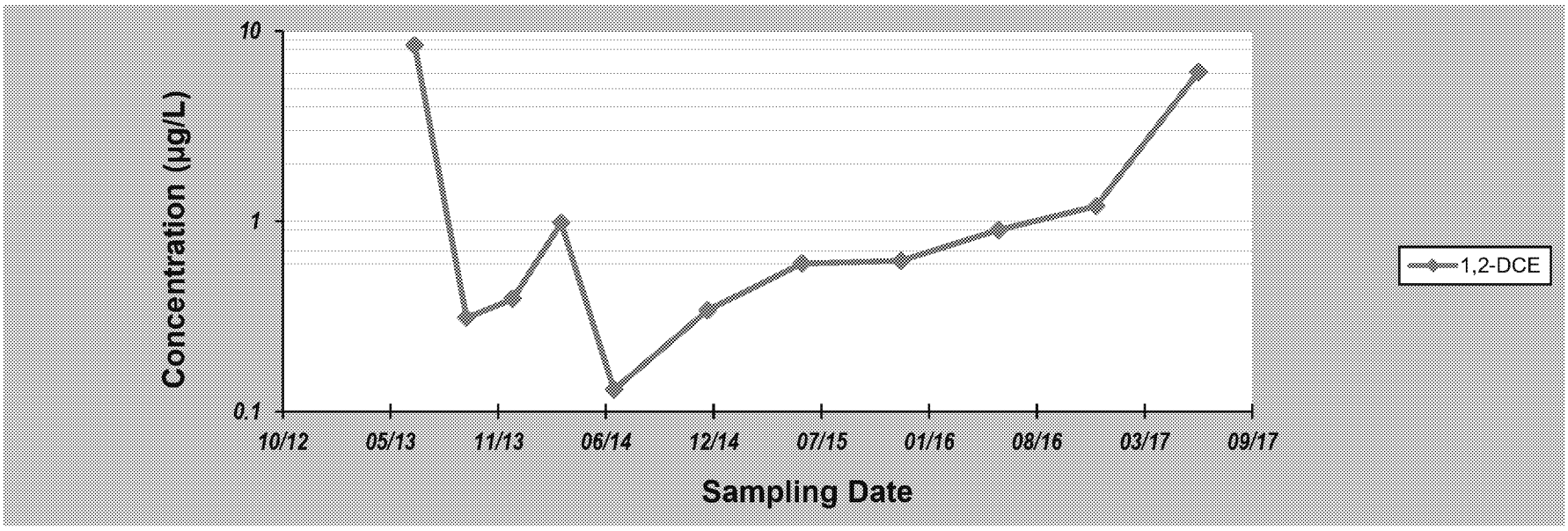
Coefficient of Variation:		1.52						
Mann-Kendall Statistic (S):		19						
Confidence Factor:		91.8%						
Concentration Trend:		Prob. Increasing						



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S5b
Facility Name:	USACE	Constituent:	Sampling location S-5
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION S-5 CONCENTRATION (µg/L)						
1	20-Jun-13	ND	ND	ND	9.3			
2	24-Sep-13	ND	ND	ND	0.3			
3	19-Dec-13	ND	ND	ND	0.34			
4	19-Mar-14	ND	ND	ND	1.4			
5	25-Jun-14	ND	ND	ND	ND UJ			
6	16-Dec-14	ND	ND	ND	0.22			
7	9-Jun-15	<0.50	<0.50	<0.50	0.77			
8	9-Dec-15	<0.50	<0.50	<0.50	1.6			
9	7-Jun-16	<0.50	<0.50	<0.50	1.5			
10	6-Dec-16	<0.50	<0.50	<0.50	1.8			
11	14-Jun-17	<0.50	<0.50	<0.50	8.6			
12								
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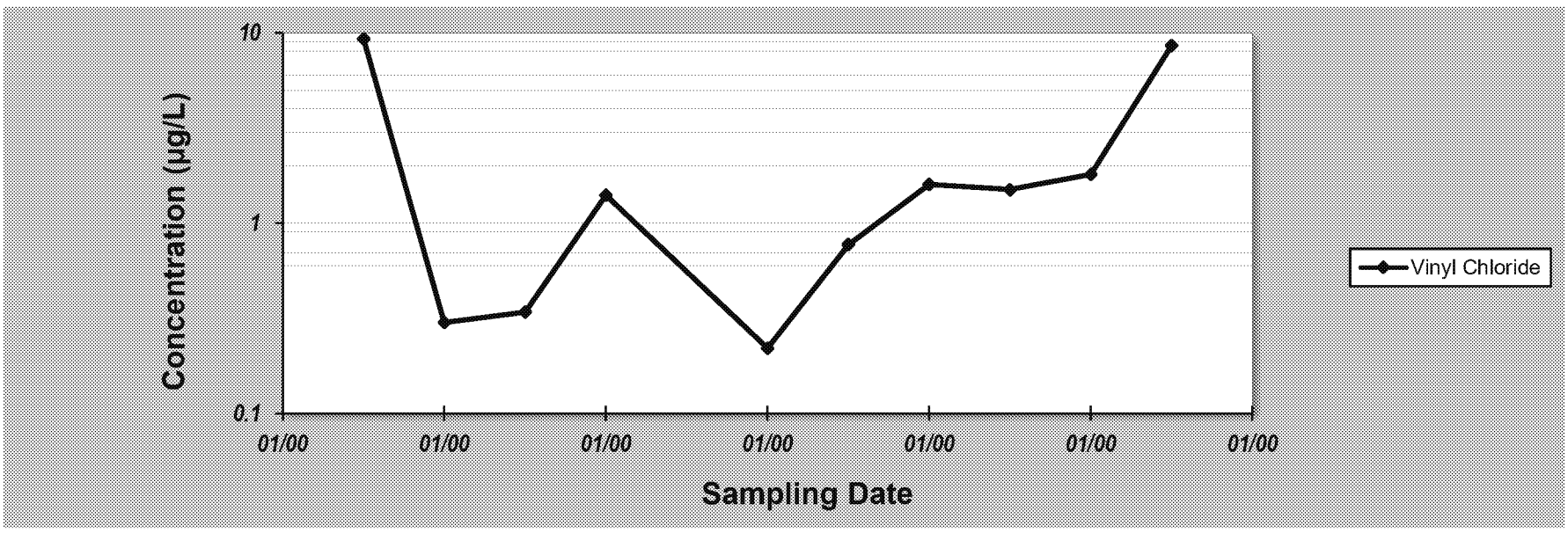
20								
Coefficient of Variation:				1.32			
Mann-Kendall Statistic (S):				17			
Confidence Factor:				92.2%			
Concentration Trend:				Prob. Increasing			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S4Ba
Facility Name:	USACE	Constituent:	Sampling location S-4B
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION S-4B CONCENTRATION (µg/L)						
1	19-Jun-13	ND	ND	0.24 J	ND	0.061 J		
2	24-Sep-13	0.040 JB	ND	0.15 JB	ND	0.064		
3	31-Jan-14	0.95	ND	ND	ND	ND		
4	20-Mar-14	0.20 J	ND	ND	ND	ND		
5	25-Jun-14	ND	ND UJ	0.090 JB	ND UJ	0.11 JB		
6	16-Dec-14	0.090 J	ND	ND	ND	0.040 J		
7	9-Jun-15	<0.50	<0.50	<0.50	<0.50	<0.50*		
8	8-Dec-15	<0.50	<0.50	<0.50	<0.50	<0.50*		
9	7-Jun-16	<0.50	<0.50	<0.50	<0.50	<0.50		
10	6-Dec-16	<0.50	<0.50	<0.50	<0.50	<0.50		
11	13-Jun-17	<0.50	<0.50	<0.50	<0.50	<0.50		
12								
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20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S4Bb
Facility Name:	USACE	Constituent:	Sampling location S-4B
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION S-4B CONCENTRATION (µg/L)						
1	19-Jun-13	ND	ND	ND	0.32			
2	24-Sep-13	ND	ND	ND	ND			
3	31-Jan-14	ND	ND	ND	0.56			
4	20-Mar-14	ND	ND	ND	0.16			
5	25-Jun-14	ND	ND	ND	ND			
6	16-Dec-14	ND	ND	ND	0.2			
7	9-Jun-15	<0.50	<0.50	<0.50	0.23			
8	8-Dec-15	<0.50	<0.50	<0.50	0.32			
9	7-Jun-16	<0.50	<0.50	<0.50	0.37			
10	6-Dec-16	<0.50	<0.50	<0.50	<0.50			
11	13-Jun-17	<0.50	<0.50	<0.50	0.41			
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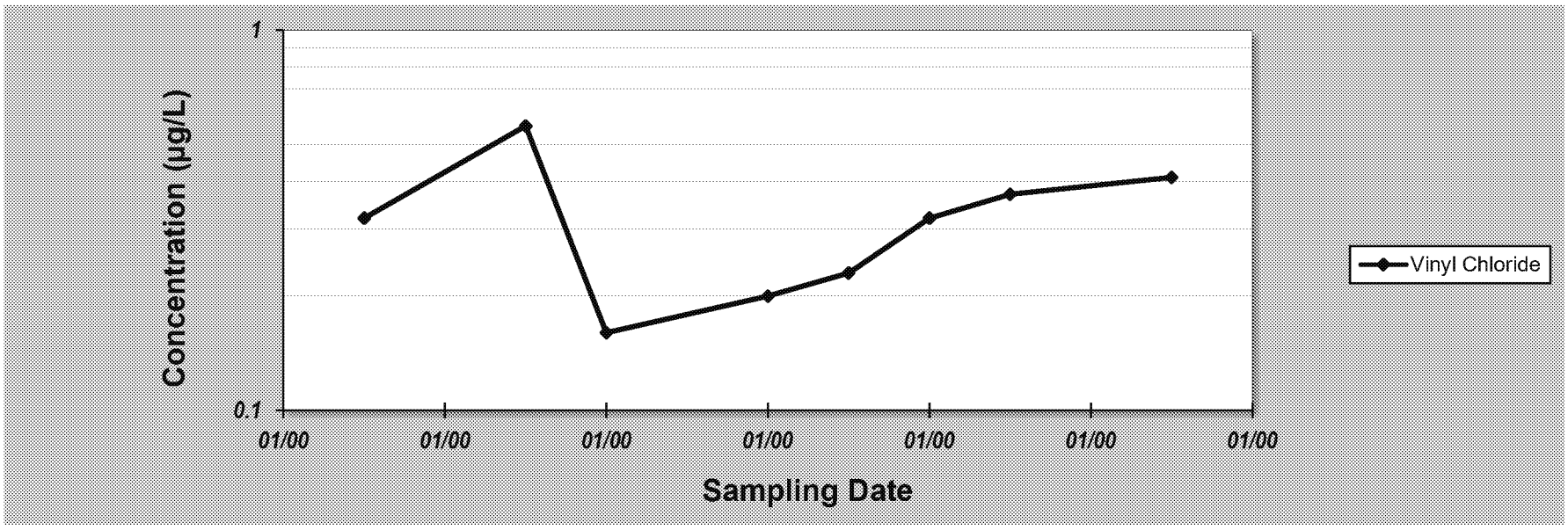
Coefficient of Variation:				0.40			
Mann-Kendall Statistic (S):				9			
Confidence Factor:				83.2%			
Concentration Trend:				No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S1a
Facility Name:	USACE	Constituent:	Sampling location S-1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,2-DCE	Ethylbenzene	Methylene	Tetrachloroethene	Toluene		
Sampling Event	Sampling Date	SAMPLING LOCATION S-1 CONCENTRATION (µg/L)						
1	19-Jun-13	ND	ND	0.14 J	ND	0.035 J		
2	24-Sep-13	ND	ND	0.19 JB	ND	0.047 JB		
3	18-Dec-13	ND	ND	0.046 JB	ND	0.06 J		
4	19-Mar-14	ND	ND	ND	ND	ND		
5	26-Jun-14	ND	ND UJ	0.062 JB	ND UJ	0.069 JB		
6	16-Dec-14	ND	ND	ND	ND	0.040 J		
7	9-Jun-15	<0.50	<0.50	<0.50	<0.50	<0.50*		
8	9-Dec-15	<0.50	<0.50	<0.50	<0.50	<0.50		
9	7-Jun-16	<0.50	<0.50	<0.50	<0.50	<0.50		
10	5-Dec-16	<0.50	<0.50	<0.50	<0.50	<0.50		
11	13-Jun-17	<0.50	<0.50	<0.50	<0.50	<0.50		
12								
13								
14								
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16								
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18								
19								
20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Nov-17	Job ID:	S1b
Facility Name:	USACE	Constituent:	Sampling location S-1
Conducted By:	Robin Sternberg	Concentration Units:	µg/L

Sampling Point ID:	1,1,1-TCA	1,1,2-TCA	TCE	Vinyl Chloride			
Sampling Event	Sampling Date	SAMPLING LOCATION S-1 CONCENTRATION (µg/L)						
1	19-Jun-13	ND	ND	ND	ND			
2	24-Sep-13	ND	ND	ND	ND			
3	18-Dec-13	ND	ND	ND	ND			
4	19-Mar-14	ND	ND	ND	ND			
5	26-Jun-14	ND	ND	ND	ND UJ			
6	16-Dec-14	ND	ND	ND	ND			
7	9-Jun-15	<0.50	<0.50	<0.50	<0.50			
8	9-Dec-15	<0.50	<0.50	<0.50	<0.50			
9	7-Jun-16	<0.50	<0.50	<0.50	<0.50			
10	5-Dec-16	<0.50	<0.50	<0.50	<0.50			
11	13-Jun-17	<0.50	<0.50	<0.50	<0.50			
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:								
Mann-Kendall Statistic (S):								
Confidence Factor:								
Concentration Trend:								

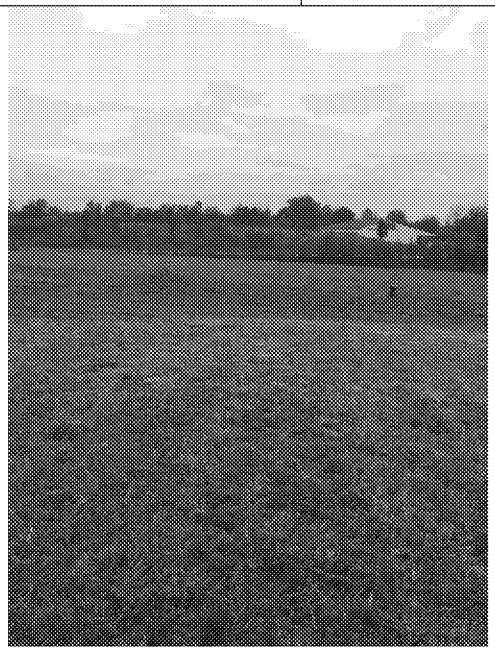
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

APPENDIX D – PHOTOGRAPHS FROM THE SITE INSPECTION

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742

Photo No. 1	Date: 10/30/2017
Direction Photo Taken: North	
Description: View of Site looking North	



Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742

Photo No. 2	Date: 10/30/2017
Direction Photo Taken: Northeast	
Description: View of Site looking Northeast	

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 3 / **Date:** 10/30/2017		
Direction Photo Taken: South		
Description: View of Site looking South		

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 4 / **Date:** 10/30/2017		
Direction Photo Taken: East		
Description: Groundwater monitoring well MW-14		

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 5 / **Date:** 10/30/2017		
Direction Photo Taken: Toward ground		
Description: Piezometer PZT1		

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 6 / **Date:** 10/30/2017		
Direction Photo Taken: Toward ground		
Description: Piezometer PZT3		

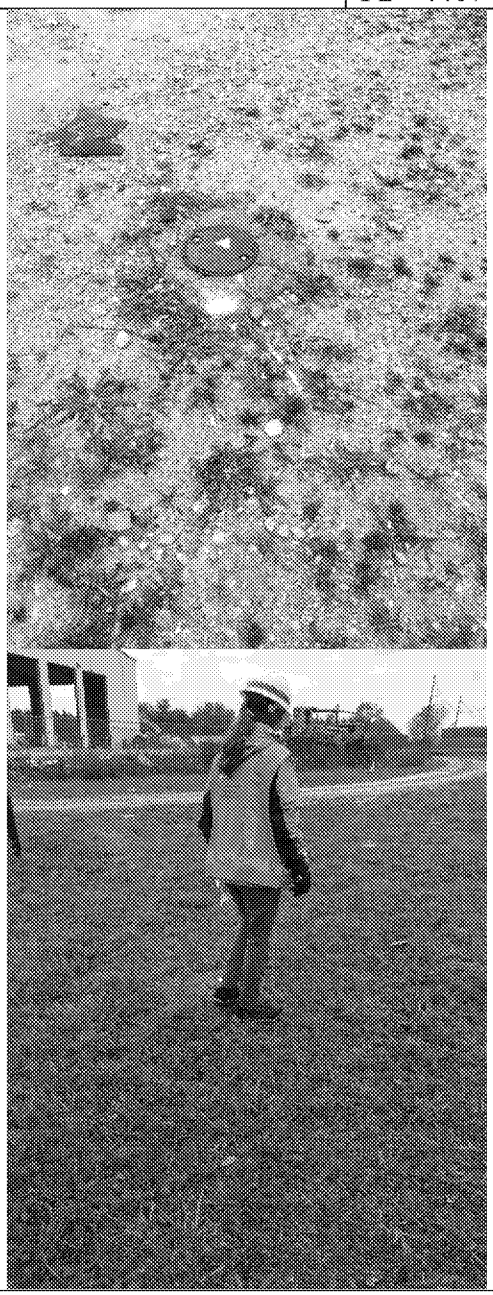
Project Name: Envirochem Site	Site Location: 865 S. South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 7 / **Date:** 10/30/2017		
Direction Photo Taken: Northwest		
Description: Groundwater monitoring well S-1		

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 8 / **Date:** 10/30/2017		
Direction Photo Taken: North		
Description: Groundwater monitoring well S-4B		

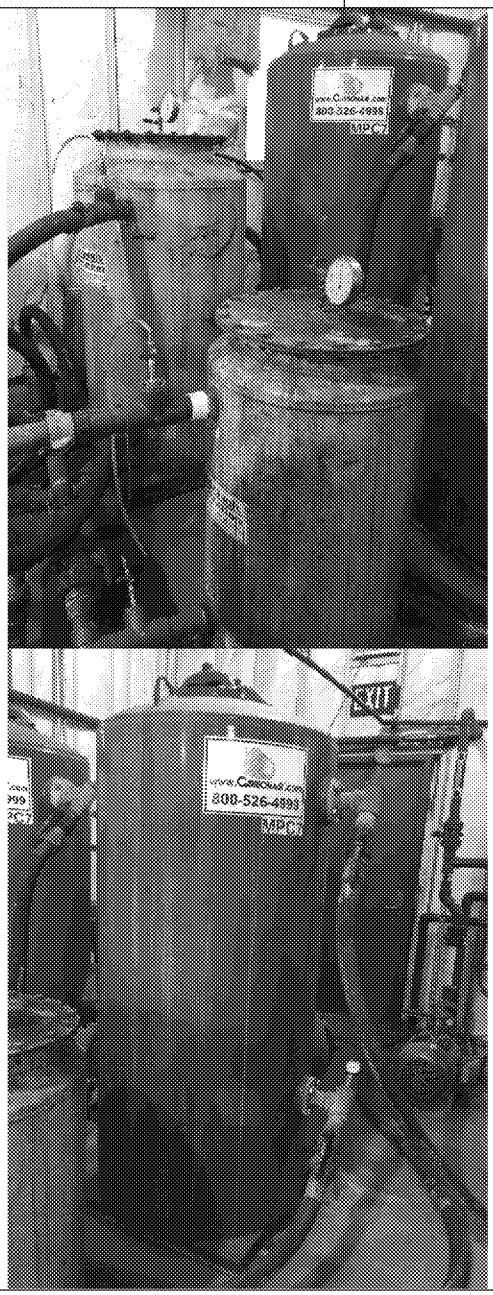
Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 9 / **Date:** 10/30/2017		
Direction Photo Taken: Toward ground		
Description: Groundwater monitoring well S-4B		

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 10 / **Date:** 10/30/2017		
Direction Photo Taken: Southeast		
Description: Groundwater monitoring well S-6		

Project Name: Envirochem Site		**Site Location:** 865 South U.S. Highway 421, Zionsville, IN	**USACE Project Number:** P2 - 446742
Photo No. 11	**Date:** 10/30/2017		
Direction Photo Taken: Toward ground			
Description: PT7 and PT8			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 12 & 13	**Date:** 10/30/2017		
Direction Photo Taken: Toward ground and north			
Description: Support area piezometers			

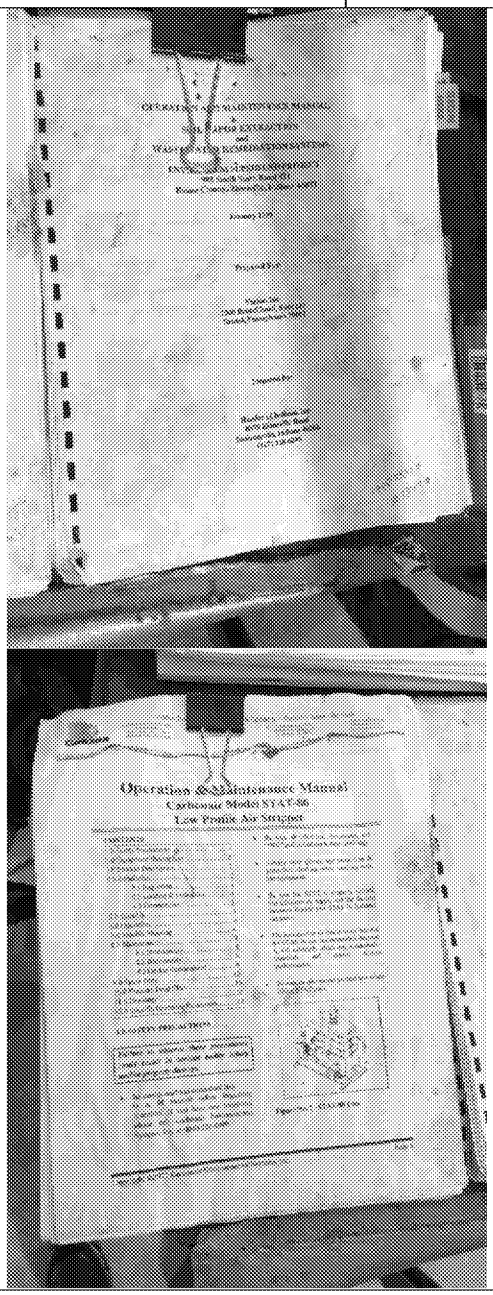
Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 14	**Date:** 10/30/2017		
Direction Photo Taken: East			
Description: Air stripping tower			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 15 & 16	**Date:** 10/30/2017		
Direction Photo Taken: Northwest			
Description: Carbon filtration tanks			

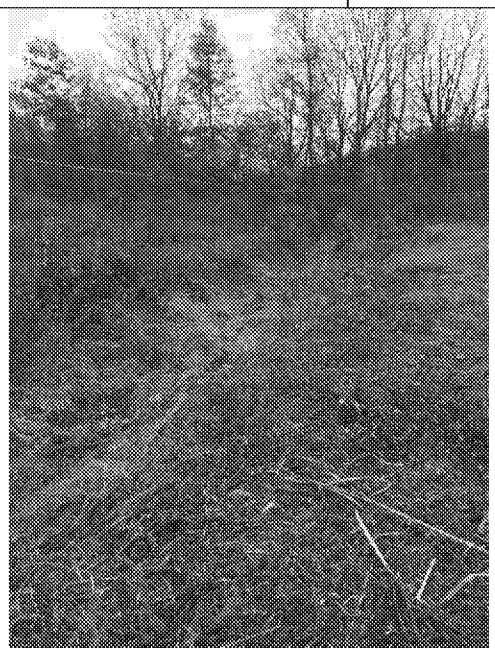
Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 17	**Date:** 10/30/2017		
Direction Photo Taken: Toward ground			
Description: Leak under carbon filtration tank piping			

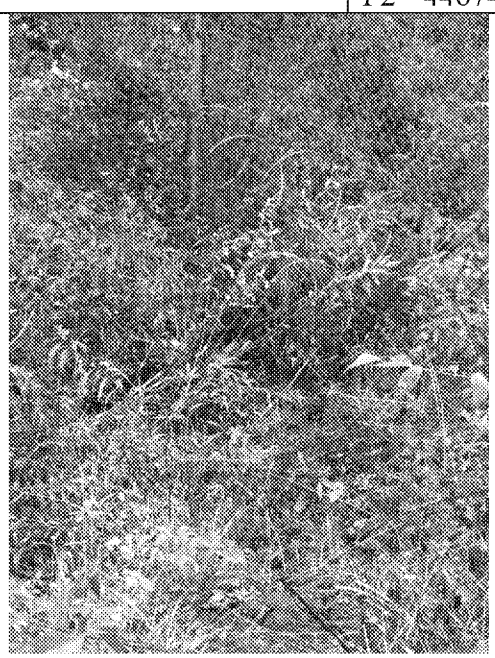
Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 18 / **Date:** 10/30/2017		
Direction Photo Taken: Towards ground		
Description: Effluent gauge		

Project Name: Envirochem Site	Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 19 / **Date:** 10/30/2017		
Direction Photo Taken: Northwest		
Description: Effluent discharge		

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 20 & 21	**Date:** 10/30/2017		
Direction Photo Taken: Toward ground			
Description: O&M manuals Manual at top dated January 1999			

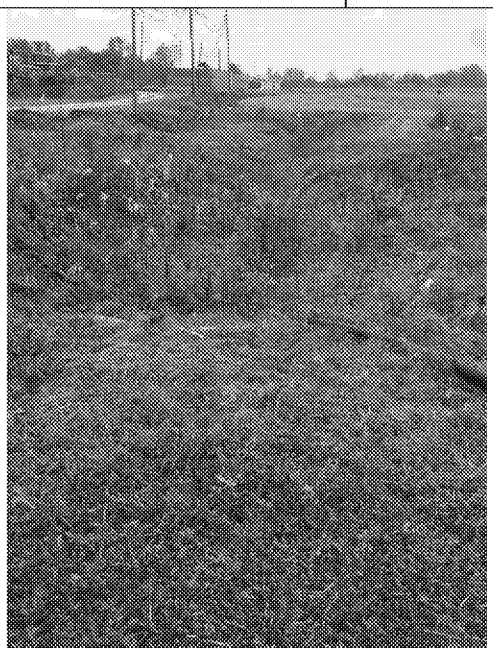
Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 22	**Date:** 10/30/2017		
Direction Photo Taken: Northeast			
Description: Electrical panel			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 23	**Date:** 10/30/2017		
Direction Photo Taken: Northeast			
Description: Northeast drainage ditch			

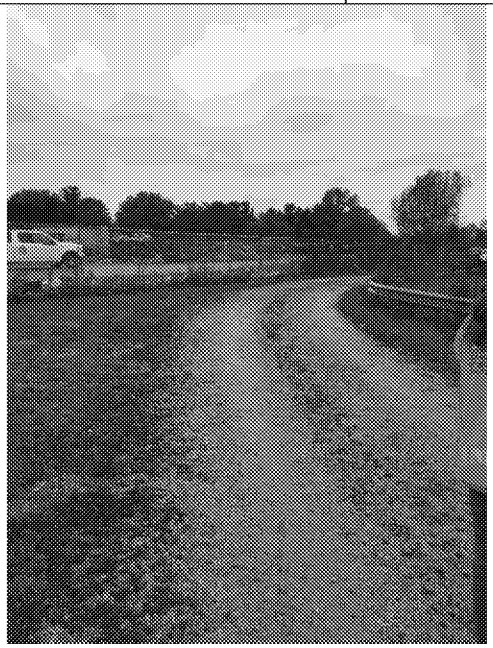
Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 24	**Date:** 10/30/2017		
Direction Photo Taken: Northeast			
Description: Northeast drainage ditch feature			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 25	**Date:** 10/30/2017		
Direction Photo Taken: West			
Description: South fence line			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 26 & 27	**Date:** 10/30/2017		
Direction Photo Taken: Southeast			
Description: Southeast drainage ditch features			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 28	**Date:** 10/30/2017		
Direction Photo Taken: North			
Description: Southwest retention			

Project Name: Envirochem Site		**Site Location:** 865 South U.S. Highway 421, Zionsville, IN	**USACE Project Number:** P2 - 446742
Photo No. 29 & 30	**Date:** 10/30/2017		
Direction Photo Taken: North (top); South (bottom)			
Description: East fence line			

Project Name: Envirochem Site		Site Location: 865 South U.S. Highway 421, Zionsville, IN	USACE Project Number: P2 - 446742
Photo No. 31	**Date:** 10/30/2017		
Direction Photo Taken: Northwest			
Description: West fence line			